THE DANISH
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CONTENTS:

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THE DANISH INGOLF-EXPEDITION.

VOLUME V.

8.

MEDUSÆ.

PART I.

LEPTOMEDUSÆ.

BY

P. L. KRAMP.

WITH 5 PLATES, 17 FIGURES IN THE TEXT, AND 14 MAPS.

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CONTENTS

Introduction.

In the present paper as also in one or two more to be published later on, the Medusæ from the northern Atlantic and adjacent waters will be dealt with. Owing to various casual circumstances the group of the Leptomedusæ has been worked up as the first. The geographical area, dealt with in the said works, comprises: the Atlantic Ocean north of Lat. 50° N., the Davis Strait, the western part of the North Sea, the Norwegian Sea, and the Polar Sea as far eastwards as the Kara Sea. The choice of the southern limit is rather gratuitous. The medusæ from the British Channel are going to be mentioned in the "Report on the Danish Oceanographical Expeditions 1908—1909 to the Mediterranean and adjacent Waters", dealing with the fauna of the Mediterranean and the Atlantic from the coast of Morocco to the British Channel. Moreover I am preparing a work on the medusæ of the Danish waters; in the present paper, therefore, I have only included some few summary remarks on the medusæ from that area.

The present paper is based particularly on the collections in the Zoological Museum of the University of Copenhagen. Besides I have made use of a smaller collection of medusæ belonging to the Plankton Department of the Danish Commission for Investigation of the Sea. For the admission to that collection I owe my best thanks to Professor C. H. Ostenfeld, the Director of the Plankton Laboratory. Moreover, during a stay in Bergen in the summer of 1916 I studied the exceedingly interesting material of medusæ collected during the first cruise of the M./S. "Armauer Hansen" in the Atlantic west of Rockall in 1913; some of the specimens were sent to me to Copenhagen for further investigation. With the permission of Professor A. Brinkmann the results of my studies have been included in the present paper. I wish to express my best thanks to Professor Brinkmann for that permission.

Some years ago I was commissioned to work up the Anthomedusæ and Leptomedusæ from the "Michael Sars" North Atlantic Deep-Sea Expedition 1910. The paper was finished in 1915, and the printing was nearly accomplished, when the great fire in Bergen on January 15th 1916 destroyed the matter in type; the printing has not yet been resumed, and as certain parts of the material dealt with in that paper are of considerable interest with regard to the problems discussed in the present work, I have made use of that material to such an extent as I found suitable.

Some of the material in the Zoological Museum of Copenhagen has previously been worked up and mentioned in the literature. Some older material has been examined by E. Haeckel and mentioned in his System der Medusen. The museum possesses a list of that material, to which Haeckel himself has added the identifications of the species. The numbers in the list are refound in the labels of the specimens. The said list is of considerable interest, as far as it has rendered it possible to correct some of Haeckel's identifications. The medusæ from Greenland were dealt with by G. M. R. Levinsen in "Meduser, Ctenophorer og Hydroider fra Grønlands Vestkyst" 1892, and, later, by the present author in "Medusæ collected by the "Tjalfe" Expedition" (1913), and "Meduser og Siphonophorer" in Conspectus Faunæ Groenlandicæ (1914). The last-mentioned paper includes a complete account of the literature relating to the medusæ of the waters of Greenland.

Besides the older material, the collections of the following expeditions have been employed in the present paper:

Wm. Lundbeck, 1892 (Iceland).

Danish "Ingolf" Expedition, 1895 and 1896 (Faeroe Islands, Iceland, and Greenland).

Inspecting-ship "Diana", A. Ditlevsen, 1902 (Iceland).

"Michael Sars", Ad. S. Jensen, 1902 (Norway and Iceland).

"Michael Sars", 1903 (Norwegian Sea).

Inspecting-ship "Beskytteren", C. V. Otterstrøm 1903, K. J. Gemzøe 1904, and F. Johansen 1905 (Iceland).

"Thor", fisheries-investigations 1903, 1904, 1905, 1906, and 1908 (British Isles, Norway, Faeroe Islands, Iceland).

"Tjalfe", 1908 and 1909 (West-Greenland).

"Armauer-Hansen", Norwegian research motorship, 1913 (West of Rockall).

The state of preservation of the material has partly been very satisfactory (formalin), particularly as far as the collections of the "Thor" and the "Tjalfe" are concerned. The material of the "Diana" is likewise generally well preserved, though it has only been treated with alcohol; the same testimony is partly applicable to the material from the "Beskytteren" collected by Gemzøe. The material from the "Ingolf" Expedition, on the other hand, is as a rule very badly preserved. Especially a great lot of specimens have been spoiled owing to the usage of osmic acid or Flemmings solution. As a matter of fact, these substances have quite a ruinous effect on medusæ, particularly so if the dissolution is too concentrated and the specimens are exposed to the influence of the fluid during a too long space of time. Not merely the pigmentation is concealed, but the animals become intransparent and very much fragile, and must be handled with the utmost care not to break during the examination. Indeed, still during the transportation in the glasses a great part of the material has been shaken into small fragments. Neither are the single organs better hardened for investigation by this method of preparation; I have tried sectioning on microtome different organs of specimens treated with Flemmings solution, and the tissues are by no means better preserved, rather more badly if anything, than in the case of animals merely preserved in common alcohol or formalin. The method of treating medusæ with fluids containing osmic acid seems to have been very favourite during a certain period; on account of sad experiences, I take this opportunity to warn against the use of these substances for preparation of medusæ.

In the case of such species, of which no modern descriptions have been given, I have carried out thorough examinations of the morphology, as far as the state of preservation has rendered such examination possible. Also in the case of well-known species I have in some cases discovered interesting structures, hitherto unobserved. It is really astonishing, how most medusæ are deficiently known with regard to their morphology. It is a well-known fact, that the classification of the Leptomedusæ is extremely difficult. I am quite aware, that a correct understanding of the systematical problems must be searched for not only through hatching experiments, by means of which we get knowledge of the connection between the hydroids and the medusæ, but also through thorough comparative-morphological investigations. As a matter of course, I cannot, in the present paper, enter into a discussion of the great and complicated systematical problems; my present knowledge of other forms of medusæ than the northern species is too deficient yet for such an undertaking. But it is my hope, that my investigations, when in course of time they are followed by others, may contribute to that understanding which, we may hope, must be reached once in the future.

In some cases I have discussed the history of a species or genus in order to remove existing confusion or to state the correct name of the species or genus in question.

The number of species of Leptomedusæ, identified with certainty, and occurring in the north-atlantic area here dealt with, amounts to a little more than 25. In the material examined by me 15 species are represented, excluding the non-identified species of *Obelia*. They belong to the families *Laodiceidæ*, *Thaumantiadæ*, *Mitrocomidæ* and *Eucopidæ*. The family of the *Æquoridæ* is not represented. In order to give a picture, as complete as possible, of the north-atlantic fauna of medusæ, I have included the species of which no material has been at my disposal, but which, according to the literature, occur within the area in question. For such species, I give a short diagnosis, mainly derived from A. G. Mayer, Medusæ of the World, 1910, together with summary remarks on their distribution.

The following 15 species have been examined:

Chromatonema rubrum Fewkes
Laodicea undulata (Forbes & Goodsir)
Ptychogena lactea A. Agassiz
Staurophora mertensii Brandt
Melicertum octocostatum (M. Sars)
Mitrocoma polydiademata (Romanes)
Cosmetira pilosella Forbes
— megalota (Maas)
Halopsis ocellata A. Agassiz
Tiaropsis multicirrata (M. Sars)
Obelia nigra Browne
Phialidium hemisphæricum (Gronovius)
— islandicum nov. spec.
Eutonina indicans (Romanes)
Tima bairdii (Johnston)

Moreover the following species have been included (printed with Petit):

Dipleurosoma typicum Boeck
Agastra mira Hartlaub
Eucope globosa (Forbes)
Eucheilota maculata Hartlaub
Saphenia gracilis (Forbes & Goodsir)
Eutima insignis (Keferstein)

Eutima elephas (Haeckel)
Octorchis gegenbauri (Haeckel)
Eirene viridula (Péron & Lesueur)
Æquorea forskålea Péron & Lesueur
Zygodactyla groenlandica (Péron & Lesueur)

Family Laodiceidæ Browne.

"Leptomedusæ with cordyli, commonly called sensory clubs, on the margin of the umbrella" (Browne 1907, p. 459).

Browne has, no doubt correctly, ascribed the significance as a family-character to the peculiar organs called cordyli. Before I enter into a further discussion of these interesting organs, I will, for the sake of comparison, shortly call attention to the structure of another kind of marginal appendages, occurring in several Leptomedusæ: *viz.* the Cirri. A cirrus is lengthened, thread-shaped, and is always inserted directly on the margin of the umbrella without possessing a basal bulb. The entoderm of the cirrus is in connection with the entoderm of the circular vessel, and it is solid (not hollow), consisting of a single series of cylindrical or disk-shaped entoderm-cells. The ectodermal epithelial cover is very delicate, consisting of flattened polygonal cells. The cirri carry nematocysts, usually in considerable number, and particularly towards the distal end. The distal part of the cirrus may, as a rule, be spirally curled up.

A typical, fully developed Cordylus is club-shaped with a thin stalk and a swollen distal part; it may or may not be mounted upon a small tubercle on the bell margin. In opposition to the cirrus, it possesses a hollow central space which, however, may be more or less obliterated; particularly the lumen has often entirely disappeared in the narrow part, the lumen of the distal thick part thus being separated from that of the circular vessel. The entoderm consists of a single layer of large, usually cubical cells surrounding the central lumen. The ectoderm is fairly thin, but not so thin as the ectoderm of a cirrus. There are no nematocysts. This is the shape of a typical cordylus. A very interesting kind of cordylus, not so highly developed, has been observed by Browne in *Ptychogena antarctica* Browne (Browne 1910). The cordyli of that species, as figured by Browne (Plate 2, figs. 7—9) do not possess the well-marked club-shaped appearance as in the case of the typical cordyli, but are only slightly more thickened distally than proximally; moreover, in some of them nematocysts were found.

I am of opinion, that the small marginal appendages in *Chromatonema rubrum* indicate a still lower stage of development of cordyli (see Plate I, figs. 2 and 3). They differ from typical cordyli by the possession of a cluster of nematocysts in the distal end and by the general shape which is cylindrical or spindle-shaped. But the ground plane, the structure of the cell-layers, is exactly as in a cordylus. Through the cordyli of *Ptychogena antarctica*, mentioned above, as the transitional form they may, I think, without difficulty be homologized with real cordyli. They may not be called cirri, as they have a central lumen, and because they are short and rigid. In a nearly related species, *Chromatonema erythrogonon* (*Ptychogena erythrogonon* Bigelow), further mentioned below, Bigelow found a few cylindrical "cirri" with nematocysts and, besides, a number of spindle-shaped "cordyli" without nematocysts. Excepting the lacking of nematocysts, these cordyli have exactly the same shape as those of *Chromatonema rubrum*, and they occupy a corresponding position on the bell margin.

Thus they must undoubtedly be characterised as another transitional form, somewhat further advanced than the corresponding organs in *Chromatonema rubrum.* — In another nearly related species, *Chromatonema hertwigi* (*Ptychogena hertwigi* Vanhöffen, see below) the same organs are, according to the figure, partly cylindrical, partly spindle-shaped, partly somewhat club-shaped; Vanhöffen calls them "cirri".

Thus we find, within the *Laodiceidæ*, a series of transitional forms of cordyli from cylindrical or spindle-shaped with a distal cluster of nematocysts (*Chromatonema rubrum*) through spindle-shaped or slightly club-shaped with or without nematocysts, to the fully developed form: actually club-shaped without nematocysts.

As different points of connection exist between the *Laodiceidæ* and the *Tiaridæ*, as will presently be demonstrated, it is a natural question, whether anything corresponding to cordyli is found among the latter. We will find then, that a single form of *Tiaridæ* possesses certain organs, which bear a considerable likeness to the lowest form of cordyli, those of *Chromatonema rubrum.* The species in question is *Tiaranna rotunda* (Quoy & Gaimard).

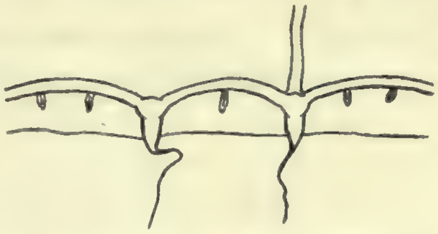


Fig. 1. Part of the bell-margin of *Tiaranna rotunda* (Quoy & Gaimard).

I deeply regret that my paper on the Anthomedusæ and Leptomedusæ of the "Michael Sars" Expedition 1910 has not yet been printed, as two species of the interesting genus *Tiaranna* have been dealt with in that paper; a reference to the accounts of these species would have facilitated the following discussion on the relation between the *Tiaridæ* and the *Laodiceidæ.* As especially *Tiaranna rotunda* is of great interest in this respect, I have thought it better to make use, in this place, of my observations relating to the matter in spite of the fact, that they are destinated for printing in another place.

Fig. 2. Dwarf-tentacle of *Tiaranna rotunda* (Quoy & Gaimard), with numerous nematocysts at the distal end.

The marginal appendages of *Tiaranna rotunda* (textfig. 1) are very much like those of *Chromatonema rubrum.* Between every successive pair of tentacles in *Tiaranna rotunda* there are one or two minute appendages like the cordyli of *Chromatonema*, only they are never cylindrical, but always spindle-shaped, and provided with a tenon-like distal part greatly armoured with nematocysts (textfig. 2). The structure of the cell-layers is exactly as in the cordyli of *Chromatonema.* Dwarf-tentacles of a similar shape, though more lengthened, are found in *Bythotiara.*

Hartlaub (1897) considered cordyli to be juvenile stages of tentacles, and he meant to have observed the development of cordyli into tentacles in *Staurophora mertensii.* Browne has discussed this question in his paper, Revision of the ... *Laodiceidæ* (1907, p. 458). Browne has examined a large number of specimens of *Laodicea undulata* (early and intermediate stages). He is of opinion, that transformation of cordyli into tentacles does not take place normally, though such transformation may happen when the margin of the bell is overcrowded with marginal organs; in such case a cordylus may stand in the way of a developing tentacle and may, thereby, be lifted up by the growing bulb and become situated on the distal end of the young tentacle; afterwards it gradually loses its rounded form and is finally absorbed. Browne rightly remarks: "If cordyli are the forerunners of tentacles one would naturally expect to see them in the earliest stage or in the very early stages; but they do not make their appearance until the Medusa has at least trebled the original number of its tentacles". Only in very few cases Browne found cordyli being converted into tentacles; on the other hand, I have observed several cases of the same phenomenon in *Staurophora mertensii.* Plate III fig. 7 illustrates different stages of cordyli being converted into tentacles in a specimen from Iceland. Fig. 7 a shows a normal cordylus without basal bulb; in fig. b is seen a normal cordylus mounted upon a young bulbus; figs. c—f illustrate some stages of the further development into a young tentacle, the distal part of which is still distinctly club-shaped; in stages, still further advanced, I have seen the bulbous terminal part in a state of absorption. On the other hand, I have also seen numerous young tentacles with an entirely pointed terminal part, tentacles which have, accordingly, never had any connection with cordyli. As a result of my investigations I may state, I believe, that Browne's view of this question is correct, though in species in which the marginal organs are very densely crowded, it will very frequently happen, that cordyli are picked up by developing tentacles.

According to Browne, the family *Laodiceidæ* comprises the following genera: *Laodicea*, *Staurophora*, *Ptychogena*, *Toxorchis*, *Staurodiscus*, and *Melicertissa.* To these we may add, I believe, the genus *Chromatonema.* Among the genera mentioned by Browne, I know only the three first by autopsy; the three others I have never seen. I will, therefore, not enter into a general account of the comparative morphology of the family. But from my studies on the species, represented in the material at my disposal, I shall call attention to certain parallels to structures within the family *Tiaridæ*, parallels which, after my opinion, render it probable, that the *Laodiceidæ* have taken their origin from that group.

One feature, common for the *Laodiceidæ* (the species examined by me) and the proper *Tiaridæ* (the *Neoturridæ* sensu Hartlaub) is the wide, open mouth tube, the free margin of which is more or less crenulated (except in the lower forms among the *Tiaridæ*), often complexly folded. The perradial corners of the mouth is, in most forms, more or less drawn out into four lips. Another common feature is the fact, that the manubrium is attached to the subumbrella along the arms of a perradial cross.

In the *Tiaridæ* the gonads are developed into folds or grooves in the walls of the stomach. Typically these grooves are arranged in the shape of four horse-shoes, the middle curves of which are placed interradially on the upper (proximal) part of the manubrium, while the arms go downwards along both sides of the perradial edges of the stomach. From this type the arrangement may be further developed in a more or less complicated manner. In some of the *Calycopsidæ* the horse-shoe-shape has been obliterated, because no sexual products are developed in the interradial parts, the gonads thus being arranged as eight adradial rows of sacks.

A characteristic structure in many *Tiaridæ* are the so-called "mesenteries", a double membrane connecting a greater or lesser part of the perradial edges of the stomach with the radial canals. These mesenteries are very differently developed in the different forms of *Tiaridæ.* In the lower forms they are quite absent; they are well-developed in such higher organized forms as *Leuckartiara*, *Catablema*, *Neoturris*, *Pandea* etc. If we imagine the mesenteries so far lengthened, that they reach as far downwards along the edges of the stomach as the gonads and, at the same time, just as far outwards along the radial canals, and if we fancy, thereafter, that they become narrowed in a dorso-ventral direction, the edges of the stomach will be drawn outwards towards the radial canals and, at last, coincide with the latter. That is, in fact, what we find in *Tiaranna rotunda* and *affinis* (figures of these species are given in my paper on the Anthomedusæ and Leptomedusæ of the "Michael Sars"). Now it is not difficult to fancy a transition from the facts as established in these species to the type of gastrogenital organs found in most *Laodiceidæ*. If the gonads disappear in the interradial parts, we have, on each side of the radial canals so far as these are connected with the edges of the stomach, a series of gonadial folds, forming together a continuous, folded band along the part of the canal concerned. An outward displacing (towards the bell-margin) of these gonads will have the effect, that the proximal ends are somewhat withdrawn from the centre of the umbrella, while the distal ends, being removed outwards, will drag along with them the adjacent parts of the wall of the stomach, forming a funnel-shaped extension of the stomach along the lower side of each of the radial canals. Then we have the type, which is found in *Ptychogena* and *Laodicea* (see below). The modification of this type within the different forms, here dealt with, will be mentioned below under the descriptions of the species.

The emancipation of the gonads from the stomach is not so far advanced in the *Laodiceidæ* (the species here described) as in the other Leptomedusæ; this indicates a lower systematical position nearer to the Anthomedusæ. In *Laodicea*, *Ptychogena* and *Staurophora* the gonads are developed in folds of the lateral walls of the radial canals; in the case of the two first mentioned genera the proximal parts of the gonads are frequently developed in the walls of the stomach along both sides of the lines (the cross-shaped figure) by which the stomach is attached to the subumbrella. In *Staurophora* the structure of the gastrogenital organs is secondarily complicated (see below). In *Chromatonema* the gonads do not form continuous bands, but consist of a row of sack-shaped invaginations on each side of the radial canals; some of the proximal gonadial sacks are situated within the corners of the stomach in the dorsal walls of the latter along the arms of the cross-shaped figure. These gonadial sacks, with their narrow, split-shaped openings, recall the gonadial sacks, arranged in rows, in *Calycopsis*.

Genus **Chromatonema** Fewkes.

Chromatonema rubrum Fewkes.

Plate I, figs. 1—8.

Chromatonema rubrum Fewkes 1882. Acalephae, East Coast of New England. — Bull. Mus. Comp. Zool. Vol. 9. No. 8, p. 305. Pl. I, fig. 41.

Thaumantias — Mayer 1910. Medusæ of the World. Vol. I, p. 199.

— — Kramp 1913. Medusæ, "Tjalfe"-Exp. — Vidensk. Meddel. Dansk naturh. Foren. Bd. 65, p. 267.

— — Kramp 1914. Meduser og Siphonophorer. — Conspectus Faunæ Groenlandicæ, p. 419.

?*Ptychogena erythrogonon* Bigelow 1909. Medusae, Eastern Tropical Pacific. — Mem. Mus. Comp. Zool. Vol. 37, p. 150. Pl. 5, fig. 1. Pl. 38, figs. 8, 9. Pl. 39, figs. 1—7.

? — *Hertwigi* Vanhöffen 1911. Deutsche Tiefsee-Exped. Bd. 19, p. 220. Taf. 22, Fig. 9. Textfig. 13.

Description. — The bell is somewhat higher than a hemisphere, the gelatinous substance very thick, evenly rounded at the top, gradually tapering towards the bell margin. The base of the manubrium is broad, quadrangular, attached to the subumbrella along the arms of a perradial cross, so that there are four triangular pouches between the dorsal wall of the stomach and the subumbrella (see the textfig. 3, which is a copy of a drawing made from a specimen from the "Michael Sars" and destinated for my paper on the material of that expedition). The mouth-tube is quadrangular, very wide. The edge of the mouth is somewhat crenulated, and the corners are a little dilatated, forming four short, simple lips. The length of the manubrium is variable; it never reaches the opening of the bell cavity, and in most specimens its length is less than $^2/_3$ of the depth of the bell-cavity; this variation may depend on the state of contraction. There are four radial canals. The proximal part ($^1/_2$—$^2/_3$) of each radial canal is wide and contains the gonads, the distal part is straight and narrow and communicates with the narrow circular vessel. The proximal part of the radial canal is funnel-shaped, communicating with the stomach by a perpendicular slit, somewhat broader at the top than at the bottom. A transverse section of the gonadial part of the radial canal is pear-shaped in the proximal part, nearly circular in the distal part. The line along which the gonadial part of the canal is attached to the subumbrella sends out a number of short lateral branches, so that the attachment of the dorsal wall of the canal has the shape of a pinnate figure (Plate I, fig. 1 and textfig. 3). Occasionally this figure is somewhat irregular, or it may be more or less zig-zag-shaped. Each of the radial canals contains two rows of sack-shaped gonads, attached to the dorsal wall of the canal in the spaces between the above-mentioned lateral branches of the line of attachment and hanging down into the cavity of the canal. The surface of a gonadial sack is covered with a thin entodermal epithelium (see Plate I, figs. 5, 6, 7, and 8), and each sack has a narrow ectodermal lumen communicating with the bell cavity through a fissure in the dorso-lateral wall of the canal (Plate I, figs. 4, 6, and 8). In view of the scarcity of room, the gonads of the two sides of the canal are more or less regularly alternating (Plate I, figs. 5 and 6). The number of gonads varies from 10 to 16 on either side of the canal. The side-walls of the canal are, as a rule, tightened closely over the gonads so that the wall becomes faintly lobed or undulated. In the upper part of the lateral walls of the canal (outside the gonads) the entoderm consists of one layer of cubical or cylindrical cells (Plate I, figs. 5 and 7). In the funnel-shaped part of the canal the lower parts of the lateral walls, which are not pressed by the gonads, are covered with a thicker entoderm, consisting of several layers of cells (Plate I, fig. 7); evidently the digestion of the food takes place in this part of the radial canal. In larger specimens some of the proximal gonads are frequently developed in the dorsal wall of the stomach on either side of the cross-arms.

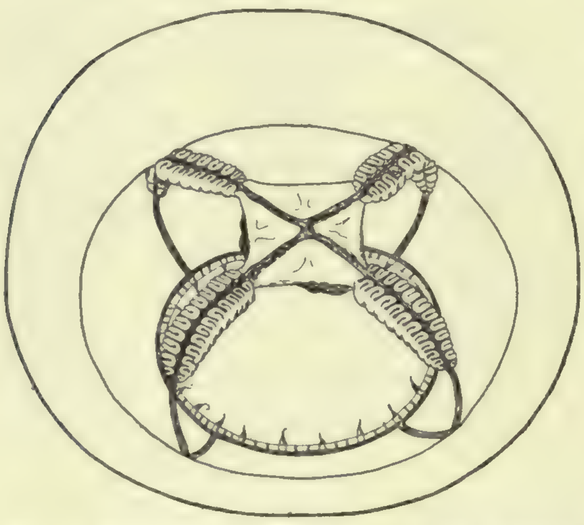


Fig. 3. *Chromatonema rubrum* Fewkes, seen obliquely from the top.

There are about 20—24 solid tentacles, all of the same shape and size; the tentacular bulb is hollow, conical, with a heart-shaped base. There is no trace of a basal spur. The tentacles may be spirally coiled (Plate I, fig. 2). In a contracted state the tentacles are deeply and closely transversally wrinkled. The tentacles seem to be fairly long, but owing to the state of preservation the exact length cannot be stated. Between every successive pair of tentacles there are two (rarely one) appendages which are, I think, homologous with the cordyli of the other *Laodiceidæ*. These cordyli are cylindrical or somewhat spindle-shaped, provided with a cluster of nematocysts in the distal end (Plate I, figs. 2 and 3); they are hollow and consist of a thin ectodermal epithelium and a thick entoderm of cubical cells in a single layer, enclosing a central lumen, which communicates with the circular vessel. The cordyli are translucent and colourless. — The velum is thin and narrow.

The colour of the manubrium, the radial canals, the circular vessel, and the tentacles is brightly orange or brick-red; moreover the tentacular bulbs contain a brownish entodermal pigment-mass. The gonadial sacks are white.

Dimensions. — The largest specimen, which I have seen ("Michael Sars" Stat. 84, 1910), is about 27 mm in diameter and about 22 mm high; it has about 24 tentacles and about 16 gonads on either side of each of the radial canals. In the Davis-Strait the species does not seem to grow to such large dimensions, the largest specimen from that area, a fully mature female individual ("Tjalfe" St. 336), being 17 mm wide, 14 mm high, with 18 tentacles, and with 13—14 gonads on either side of each radial canal. A male specimen from the Irminger Sea ("Thor" Stat. 180, 1904) shows the following dimensions: diameter 14 mm, height 12 mm, length of the gonadial part of the radial canals 6 mm, breadth of the same $2^1/_2$ mm, length of the distal narrow part of the radial canals $3^1/_2$ mm, 12 pairs of gonads on each radial canal, number of tentacles not stated.

Distribution. — Widely distributed in the deep parts of the northern Atlantic north of about 40° N. Towards the North the distribution is limited by the submarine ridge Scotland—Faeroe Islands—Iceland—Greenland—Baffin Land. The northernmost locality is: Lat. 65° N., Long. 54° W. (Møller), southernmost: Lat. 39° 52′ N., Long. 69° 45′ W., westernmost: Lat. 39° 57′ N., Long. 70° 15′ W., easternmost: Lat. 61° 15′ N., Long. 9° 35′ W.

Bathymetrical Distribution. — The species occurs almost exclusively in the deeper strata. Most specimens have been caught with instruments for pelagical fishing with 1000—3000 m wire out, i. e. about 600—2000 m below the surface. During the Atlantic expedition of the "Michael Sars" in 1910, however, a specimen was taken by a haul with 100 m wire (stat. 81, Lat. 48° 02′ N., Long. 39° 55′ W.), and in one case the species has even been taken with a hand-net at the surface, *viz.* off the west-coast of Greenland by H. P. C. Møller (see below).

The first published description and figure of this medusa were given by Fewkes (1882). But the species has been figured and described many years before, though that figure as well as the description seems to have disappeared.

In the Zoological Museum of the University of Copenhagen I have found a specimen, collected by H. P. C. Møller off the west-coast of Greenland. Though only slight traces of the gastrogenital organs are left, these slight traces in connection with the tentacles, which are fairly well preserved, partly expanded, and the entire shape of the medusa, with its very thick gelatinous substance, put it beyond doubt that the specimen must be referred to the species *Chromatonema rubrum*. The specimen was in a glass-tube with a label of the content shown on p. 10. The Zoological Museum possesses a large number of notes and drawings made by H. P. C. Møller, who was inspector in Greenland for some years about 1840. On his journeys he made considerable zoological collections, particularly of molluscs, and put down his observations in his journals. While looking through these old papers I succeeded in finding the "*Oceania cardinalis*" mentioned in a journal from 1843; among some other notes from June 13th is the following: "June 13th, off Napparsok. Last night the weather was completely calm, and with the hand-net several things were fished to me at a distance from the land of about 40 miles, to wit: a remarkably pretty small Acaleph, which I have not seen before, and which I have drawn and described this afternoon (provisionally I will call it *Oceania cardinalis*) . . ."[1] Now was the question: where are that drawing and description? With the exception of the date and the locality, the marks on the label could give me no information. At first I could not even understand the significance of these marks, until I found, that they are partly due to erroneous copying: "Sp. F Journal" ought to be "Sp. S. Journal", i. e. "Spanske Sø Journal" (Møller calls the Atlantic with the name of Spanske Sø (Spanish Sea), and one of his journals bears that title); and "76" is a mistake for "Tb", i. e. "Tabula". And when I found "Spanske Sø Journal Tab. III, fig. A" I saw a drawing of some crustacean. It is evident, however, from the journal of 1843 that a description and drawing must have been made, but in spite of keen searching I have not found them. It is probable, however, that they have disappeared very soon, because the species is not included in Mörch's list of the Acalephs of Greenland, 1857. The species mentioned in that list have been derived "partly from descriptions in Fabricii Fauna Groenlandica, partly from various posthumous drawings of H. P. C. Møller" (loc. cit. p. 98).

Oceania cardinalis
13. Juni. Sukkertopp.
Sp. F. Journ. 76.
III fig. A.
Møller.

This find is of considerable interest, because it is the only time the species has been found at the surface and because the said locality is the northernmost place, where the species has hitherto been found. Napparsok is on the west-coast of Greenland a little south of Sukkertoppen. According to the quoted journal of Møller the position of the locality must be: Lat. 65° N., Long. 54° W.

The description of Fewkes is based upon 7 specimens, found during the investigations of the U. S. Fish Commission off the southern coast of New England in 1881, stat. 936 and 954. These stations are near the northern limit of the Gulf-Stream. The depth in which the specimens were taken, is not seen from the available data. Fewkes's description and figure are very deficient, probably owing to the bad state of preservation of the specimens. The gonads are said to occupy the proximal one-third of the radial canals, and Fewkes speaks about large white eggs (which evidently mean the white gonadial sacks), which, according to the figure, are placed irregularly within the "gonads". In every other respect the specimens, examined by me, agree so well with the description and figure given by Fewkes that I have not the slightest doubt, but that they belong to the same species. As to the systematical position of the medusa, Fewkes states that it is "apparently allied to *Staurophora*", but that the determination of its exact position is difficult; he will, therefore, provisionally call it with the name of *Chromatonema rubrum*, till its position can be fixed.

Mayer (1910) quotes the description of Fewkes and places the species within the genus *Thaumantias*.

[1] "Den 13. Juni, paa Höiden af Napparsok. Inat var det aldeles stille og der blev da med Ketzeren fanget adskilligt til mig i en Afstand fra Landet af en halv Snees Mile, nemlig en udmærket smuk lille Acaleph, som jeg ikke för har seet, og som jeg i Eftermiddag har tegnet og beskrevet (jeg vil forelöbig kalde den *Oceania cardinalis*) . . .".

During the cruise of the "Tjalfe" to the west-coast of Greenland in 1909 seven medusæ were found in deep water in the Davis Strait; they were identified by me as belonging to the species here dealt with and shortly mentioned with the name proposed by Mayer, *Thaumantias rubrum* (Kramp 1913), and with the same name I included the species in my list of the medusæ of Greenland in "Conspectus Faunæ Groenlandicæ" (Kramp 1914). A more detailed description of this interesting medusa was postponed, till I had examined the specimens, taken on the "Michael Sars" North-Atlantic Deep-Sea Expedition 1910; these specimens had already arrived to me in the Zoological Museum. As my paper on the "Michael Sars" medusæ has not yet been printed (cf. p. 1), I have given the description in extenso in the present paper and, moreover, added several new observations, made on the material from the "Tjalfe" and on two specimens collected during the cruise of the "Thor" in 1904. During the cruise of the Norwegian motor-schooner "Armauer Hansen" in the Atlantic in 1913 5 specimens of the same species were found, which I had the opportunity of examining in Bergen in 1916.

Altogether 34 specimens of this medusa are known up to now. 27 of these specimens have been at my disposal for examination.

In the following complete list of the localities, where the species has been found hitherto, the localities are arranged in the following manner: 1. the Greenland occurrences from the North towards the South, 2. the Atlantic occurrences from the West towards the East.

Lat. 65° N., Long. 54° W., about 40 miles west of Napparsok on the west-coast of Greenland. June 13th 1843. Surface. H. P. C. Møller. — 1 specimen.

Lat. 64°06′ N., Long. 55°18′ W., Davis Strait. May 8th 1909. Depth 1046—1100 m. Ringtrawl, 1200 m wire. "Tjalfe" stat. 336. — 4 specimens, 11—17 mm wide with 15—18 tentacles (for further details, see Kramp 1913 p. 267).

Lat. 63°18′ N., Long. 54°55′ W., Davis Strait. May 7th 1909. Depht 1300 m. Ringtrawl, 1530 m wire. "Tjalfe" stat. 333. — 3 specimens, 9—15 mm wide.

Lat. 39°57′ N., Long. 70°15′ W., 91 miles S 1/2 E of Martha's Vineyard, New England. August 23rd 1881. Depth 1174 m (642 fms.). U. S. Fish Comm. stat. 954. (Fewkes 1882). — 2 specimens.

Lat. 39°52′ N., Long. 69°45′ W., 104 1/2 miles S. by E. 1/2 E. of Martha's Vineyard, New England. August 4th 1881. Depth 1289 m (705 fms.). U. S. Fish Comm. stat. 936. (Fewkes 1882). — 5 specimens.

Lat. 42°59′ N., Long. 51°15′ W., southern edge of the Newfoundland Bank. June 30th 1910. Depth 1100 m. Ringtrawl, 700 m wire. "Michael Sars" stat. 70. — 1 specimen, diameter 23 mm.

Lat. 47°34′ N., Long. 43°11′ W., eastern slope of the Newfoundland Bank. July 11th 1910. Depth about 2000 m. "Michael Sars" stat. 80. — a. Young-fish trawl, 1000 m wire. 2 specimens. — b. Ringtrawl, 1500 m wire. 2 specimens.

Lat. 48°02′ N, Long. 39°55′ W. July 12th 1910. "Michael Sars" stat. 81. — a. Ringtrawl, 100 m wire. 1 specimen. — b. Young-fish trawl, 1000 m wire. 1 specimen, diameter about 17 mm, about 20 tentacles. — c. Young-fish trawl, 2000 m wire. 1 specimen, diameter 16 mm.

Lat. 48°24′ N., Long. 36°53′ W. Juli 13th 1910. "Michael Sars" stat. 82. — a. Young-fish trawl, 1000 m wire. 1 specimen, diam. 21 mm. — b. Young-fish trawl, 2000 m wire. 1 specimen.

Lat. 48°04' N., Long. 32°25' W. July 15th 1910. "Michael Sars" stat. 84. — a. Ringtrawl, 2500 m wire. 1 specimen, diam. 26 mm. — b. Young-fish trawl, 3000 m wire. 1 specimen, diam. about 27 mm, about 24 tentacles.

Lat. 54°51' N., Long. 28°15' W. July 17th—18th 1913. 1000 m wire. "Armauer Hansen" stat. 9. — 3 specimens: 1. Diam. about 17 mm, three-rayed. 2. Diam. 19 mm, height 15 mm, 20 tentacles. 3. A large, defect specimen.

Lat. 54°05' N., Long. 26°08' W. July 15th 1913. 1000 m wire. "Armauer Hansen" stat. 7. — 2 specimens, diam. 18—22 mm.

Lat. 61°34' N., Long. 19°05' W., Irminger Sea. July 10th 1904. Depth 2160 m. Young-fish trawl, probably 1800 m wire. "Thor" stat. 180 (04). — 1 specimen, diam. 14 mm.

Lat. 61°15' N., Long. 9°35' W., north-west of the Faroe Bank. May 22nd 1904. Depth 872—970 m. Young-fish trawl, 1000—1700 m wire. "Thor" stat. 99 (04). — 1 specimen, diam. 15 mm, about 16 tentacles.

The specimens from the "Michael Sars" and the "Armauer Hansen" are in Bergens Museum, the specimens from the "Thor" and the "Tjalfe" are in the Zoological Museum of Copenhagen.

Among the 5 specimens from the "Armauer Hansen" two are abnormally developed. One specimen from stat. 9 has only three radial canals; a specimen from stat. 7 shows the following features: It is a female individual, 22 mm in diameter. One of the four radial canals bifurcates at the point of issue from the stomach, forming two complete gonadial systems; at the distal ends of these the two branches of the canal unite once more, so that the distal part of the canal, free of gonads, is simple. Two others of the canals, otherwise normally shaped, converge very much in their distal parts and reach the circular vessel so near each other, that only one tentacle finds room between them.

The distribution of *Chromatonema rubrum* (see Chart I) is true oceanic and extends over the deep basins of the North-Atlantic on both sides of the submarine ridge which divides the Atlantic into a western and an eastern basin. The distribution of the species in the western basin extends northwards to the southern slope of the submarine ridge between Greenland and Baffin Land. In the eastern basin the north-limit of the distribution is the Wyville Thomson ridge. With two exceptions, viz. Møller 1843 (see below) and "Thor" Stat. 99 (depth 872—970 m), all of the localities are from outside the 1000 m line. The specimens mentioned by Fewkes were taken on the slope outside the coast of New England south of Cape Cod. The "Michael Sars" found the species on the southern slope of the Newfoundland Bank (depth 1100 m) and east of the same bank (depths more than 2000 m). The specimens brought home by the "Armauer Hansen" were found near the 3000 m line, and by the "Thor" the species was found outside the 2000 m line south of Iceland (stat. 180), and near the 1000 m line north-west of the Faroe Bank (stat. 99). The "Tjalfe" found it between 1046 and 1300 m in the Davis Strait.

The species has mostly been found far below the surface of the ocean, between 600 and 2000 m, i. e. in the true oceanic water. Thus in the Gulf-Stream area the species does not, as a rule, rise to the water-masses of that current, but keeps itself in the deeper and colder water layers. The "Michael Sars" stat. 70 on the southern edge of the Newfoundland Bank is north of the northern limit of the Gulf-Stream; here a specimen was caught about 400 m below the surface.

Though the species has, mainly, a bathypelagical occurrence, it may, however, occasionally rise to the upper water layers. On "Michael Sars" stat. 81 a specimen was fished by the ringtrawl with 100 m wire in water of a fairly high temperature (about 13° C).

More astonishing is the find, made by Møller, off the west coast of Greenland (see above, p. 9). It is a well-known fact that oceanic deep-sea organisms are occasionally carried towards the west coast of Norway and found there near the shore and in the upper water layers. Similar pheno-

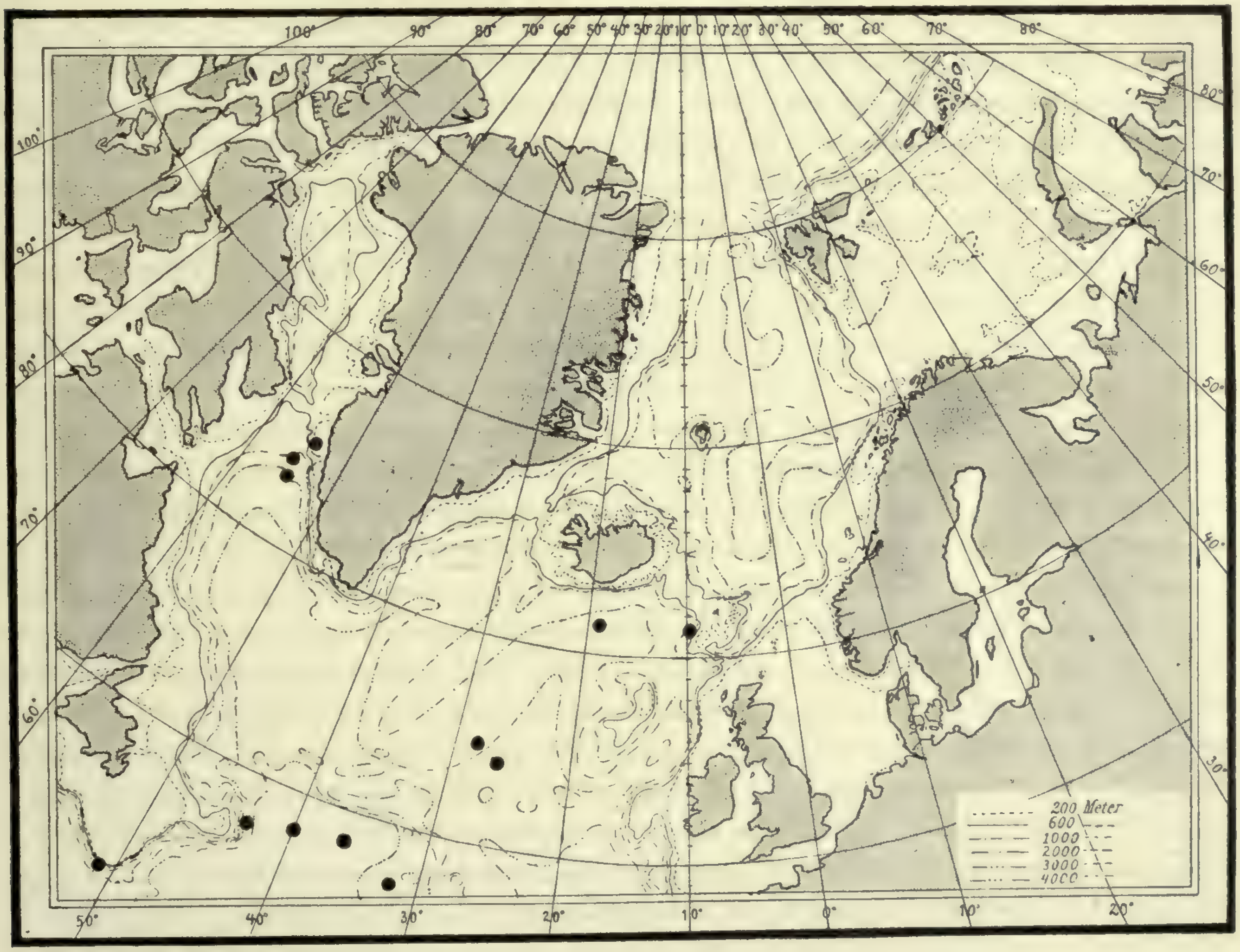


Chart I. Occurrence of *Chromatonema rubrum* Fewkes in the northern Atlantic.

mena have been observed on the west coast of Greenland, and this may account for the appearance of this oceanic deep-sea medusa comparatively near the coast and swimming at the surface of the water.

The hydroid stage is unknown, and no young stage of the medusa has been observed; it is impossible, therefore, to state, or even to guess, anything with regard to the development of the species.

Related Species. — Bigelow (1909) has described a similar medusa from the eastern tropical Pacific (the Humbolt-Current off the coast of Peru, in intermediate strata). He called it *Ptychogena erythrogonon*. Bigelow possessed a series of specimens in different stages of growth, the largest being 38 mm in diameter by 25 mm high. The general appearance of the species bears a striking resemblance to that of *Chromatonema rubrum.* The largest specimens have as much as about 64 tentacles; the tentacle bulbs have exactly the same shape as in *Chromatonema rubrum* (op. cit. Plate 39, fig. 5). According to the description Bigelow's species possesses both cirri and cordyli. Only a few cirri were present in his specimens; they are cylindrical and provided with a cluster of nematocysts in the distal end. The cordyli are spindle-shaped and carry no nematocysts. One or two cordyli are present between every two successive tentacles. As mentioned above the cordyli of *Chromatonema rubrum* may be cylindrical or more or less spindle-shaped, in both cases provided with nematocysts, and they are situated in a manner very similar to the arrangement of the cordyli described by Bigelow. The "cordyli" of "*Ptychogena erythrogonon*" are undoubtedly homologous with the cordyli of *Chromatonema rubrum*; as to the homologies of the "cirri" of the former I am not quite sure; the drawing of a single "cirrus" (Plate 38, fig. 9) recalls the cylindrical form of cordyli in *Chromatonema rubrum*, only a little more lengthened and somewhat more heavily armoured with nematocysts; in fig. 5 of Plate 39, however, the name of "cirrus" is attached to an organ which is undoubtedly a young tentacle.

As in *Chromatonema rubrum*, the base of the manubrium of "*Ptychogena erythrogonon*" is quadrate and attached to the subumbrella along the arms of a perradial cross. The mouth-tube is said to be barrel-shaped, while I have described it as being quadrangular in *Chromatonema rubrum*; but it is very likely, that the mouth-tube of the last-named species may attain a circular outline when fully expanded; such is the case in several other species, in which the stomach is quadrate when not expanded. The shape of the radial canals and the gonads of "*Ptychogena erythrogonon*" is exactly as in *Chromatonema rubrum*, the radial canals having "developed a series of short lateral diverticula along the narrow lines by which they are attached to the subumbrella (Plate 39, fig. 2). The main bodies of the canals, however, are so stout that they extend out as far as the ends of these short branches. The gonads develop in the spaces between the diverticula, and are confined to the aboral surfaces of the canals close to the subumbrella ..." (op. cit. p. 151). The distal narrow part of the radial canal is shorter in "*Ptychogena erythrogonon*" than in *Chromatonema rubrum.* — The colour seems to be the same in both species. — The two species are undoubtedly nearly related and must be referred to the same genus. In fact, I can see no other noticeable differences than the want of nematocysts in the cordyli of the Pacific species, and the size, *Chromatonema rubrum* reaching maturity when about 20—24 mm in diameter with about 20—24 tentacles, whereas *Chromatonema erythrogonon* grows to a larger size and may possess 64 tentacles when fully developed.

Another similar form is described by Vanhöffen (1911) as *Ptychogena Hertwigi*, found in the Indian Ocean by the German deep-sea expedition. Vanhöffen describes his species as very like *Ptychogena erythrogonon* Bigelow, but still larger, 50 mm in diameter, yet with a smaller number of tentacles, viz. 20. It has no cordyli but 5 cirri between each successive pair of tentacles. The "cirri", as shown in the figure in the text, seem to be partly cylindrical, partly somewhat club-shaped, partly spindle-shaped. According to the coloured figure (Taf. XXII, Fig. 9) the gonads reach only to the middle of the radial canals. Also this species is undoubtedly nearly related to *Chromatonema rubrum* Fewkes and belongs to the same genus.

Further investigations will show whether the three species mentioned are distinct or only local varieties of one and the same species, viz. *Chromatonema rubrum* Fewkes.

Table I. Synoptic Table of the Species of Chromatonema.

	C. rubrum Fewkes	C. erythrogonon Bigelow	C. hertwigi Vanhöffen
Diameter of full-grown medusa	24—27 mm	38 mm	50 mm
Number of tentacles in full-grown medusa	ca. 24	ca. 64	20
Number of cordyli between each successive pair of tentacles	2 (1)	1 (2)	5
Occurrence	Northern Atlantic Ocean	Eastern tropical Pacific	Indian Ocean

Systematical Position. — The structure of *Chromatonema* presents, in several regards, a considerable resemblance to the members of the family *Laodiceidæ* previously known, particularly to the genera *Laodicea* and *Ptychogena*. In all of the three genera the manubrium has the same shape: the square stomach, the broad base of which is attached to the subumbrella along the arms of a perradial cross; the short, wide mouth-tube, and the folded mouth-edge, in the four corners of which lips are just indicated. Common for the three genera is, moreover, the structure of the four radial canals; the proximal part of each of the canals contains the gonads; the ventral part of this gonadial part is funnel-shaped and is the proper digestive part of the canal. In *Chromatonema* as in *Ptychogena* the dorsal line of attachment of the radial canal to the subumbrella is pinnate, and in older individuals of all of the three genera the proximal part of the gonads may be developed within the corners of the stomach in the dorsal wall of the latter on both sides of the arms of the perradial cross. But with regard to the structure of the gonads *Chromatonema* presents a considerable difference, not only from *Ptychogena* and *Laodicea*, but from all other Leptomedusæ. As described above each of the radial canals in *Chromatonema* carries two rows of sack-shaped gonads, completely independent of one another. In all other Leptomedusæ each radial canal bears either two lateral gonads, forming two continuous masses in the ectoderm of a certain part of the lateral walls of the canal, or only one gonad completely surrounding a shorter or longer part of the canal. (A special case is the gonads of certain species of *Eutima*, being transversally divided into two separated pairs of gonads, one pair on the subumbrella, one pair on the stomachal peduncle). In some forms the gonadial bands are straight and linear, in others they are more or less undulated or folded. In *Laodicea* the lateral walls of the gonadial parts of the radial canals have a number of short lateral pouches; in *Ptychogena* these pouches are much more highly developed and have attained the shape of vertical lamellæ, the dorsal edges of which are attached to the subumbrella; but still there is only one gonad on each side of the canal; there is only one gonadial band, but it is highly folded. In *Staurophora* the gonads have a similar structure, but the folding is still more complicated.

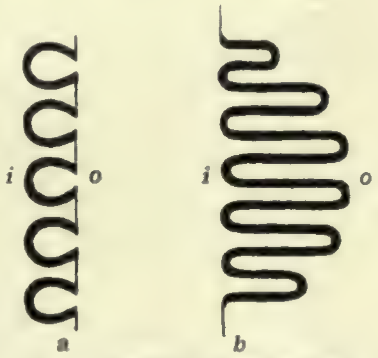


Fig. 4. Diagrams, showing the structure of the gonads of *Chromatonema* (*a*) and *Ptychogena* (*b*). — *i* inner side, *o* outer side.

The structure of the gonads of a *Chromatonema* and a *Ptychogena* may be illustrated by a diagrammatic figure as the textfig. 4. This diagram corresponds to that by which Hartlaub (1914, p. 347) illustrates the typical folding of the gonads in the two groups of *Tiaridæ*, viz. the *Calycopsidæ* and the *Neoturridæ*. It is not difficult to refer the two types to a common ground-plane, and though the peculiar structure of the gonads of *Chromatonema* places that genus in opposition to the other members of the family *Laodiceidæ*, this structure does not contradict the supposition of a generic relationship.

The parallel between the structure of the gonads of *Chromatonema* and of the *Tiaridæ* mentioned above is hardly a casual one. There is, in fact, a striking resemblance between the gonads of *Chromatonema* and the eight adradial rows of gonadial sacks, communicating with the bell-cavity through transversal fissures in the outer surface of the manubrium in a *Calycopsis* (see the figure of Bigelow, copied by Hartlaub, 1913, p. 347, and the transversal section, Vanhöffen, 1911, Textfig. 10 a, p. 216, copied by Hartlaub, 1913, p. 348. Compare also Hartlaub's Fig. 238, (1913, p. 287) of the gonads of a young *Leuckartiara octona*, seen from the inner side of the manubrium). The importance of the resemblances between the gonads of the *Tiaridæ* and the gonads of *Chromatonema* and the other *Laodiceidæ* is mentioned above in the introduction to the family *Laodiceidæ* (pp. 6—7). The marginal appendages of *Chromatonema* and their relations to the corresponding organs of the other *Laodiceidæ* and the *Tiaridæ* were also mentioned above.

Thus my considerations with regard to the systematical position of *Chromatonema* lead to the result, that it belongs to the family *Laodiceidæ*, among which it takes a low position, presenting several features pointing to the connection with the *Tiaridæ*. Its position among the *Laodiceidæ* is, however, not only a low, but also in certain regards a singular position, particularly owing to the peculiar structure of the gonads, and it seems probable that the genus has arisen from some other group of *Tiaridæ* than the predecessors of the other members of the *Laodiceidæ*.

Genus **Laodicea** Lesson.

Laodicea undulata (Forbes & Goodsir).

Plate II, figs. 1—8.

?*Medusa cruciata* Forskål 1775. Descriptiones Animalium, p. 110. — 1776. Icones rerum naturalium. Tab. 5, Fig. A.

Thaumantias undulata Forbes and Goodsir 1851. — Transact. Royal Soc. Edinb. Vol. XX, p. 313. Plate 10, fig. 7.

— *mediterranea* Gegenbauer 1856. — Zeitschr. wiss. Zool. Bd. VIII, p. 237. Taf. 8, Fig. 1—3.

Laodicea calcarata A. Agassiz, in L. Agassiz 1862. Contrib. Nat. Hist. U. S. Vol. 4, p. 350.

Laodice ulothrix Haeckel 1879. System d. Medusen, p. 133. Taf. 8, Fig. 5—7.

Laodicea marama A. Agassiz and Mayer 1899. Acalephs, Fiji Islands. — Bull. Mus. Comp. Zool. Vol. XXXII, p. 162. Plate 3, figs. 7—8.

Laodice indica Browne 1905 b. — Pearl Oyster Fisheries, Suppl. Rep. 27, p. 136. Plate I, fig. 5; Plate IV, figs. 7—11.

— — Browne 1907. Revision of the ... Laodiceidæ. — Ann. Mag. Nat. Hist. Ser. 7, Vol. XX, p. 460.

Laodicea cruciata Mayer 1910. Medusæ of the World, p. 201. Textfigs. 104—105. Plate 21, figs. 4 and 5; Plate 22, figs. 2—6; Plate 23, figs. 1—3.

— *Bigelowi* Neppi et Stiasny 1911. Zool. Anz. Bd. 38, p. 396.

? *Laodicea fijiana* A. Agassiz and Mayer 1899. — Bull. Mus. Comp. Zool. Vol. 32, p. 163. Plate 3, figs. 9—10.
? *Laodice* — var. *indica* Maas 1905. Craspedote Medusen d. Siboga-Exped. — Siboga-Exped., Monogr. X, p. 25. Taf. 2, Fig. 14—15; Taf. 5, Fig. 32—35.
? — *Maasii* Browne 1907. Revision of the ... Laodiceidæ. — Ann. Mag. Nat. Hist. Ser. 7. Vol. XX, p. 466.
? — *maasi* Vanhöffen 1911. — Deutsche Tiefsee-Exped. Bd. 19, p. 221.

Description: The bell somewhat flatter than a hemisphere. The gelatinous substance not very thick, about 2—3 mm at the apical point, evenly diminishing in thickness towards the bell-margin. The diameter of the bell is usually about 25 mm, but it may amount to 37 mm. The stomach is quadrate, spacious; its diameter is about one-fourth of the diameter of the bell. The stomach is fairly short, and the walls are rather thin. The mouth edge is folded in large folds; lips are just indicated, the four corners of the mouth being a little dilatated. The mouth-edge bends outwards, forming a narrow, outturned edge. The dorsal wall of the stomach is attached to the subumbrella along the arms of a perradial cross, four flat, triangular pouches being formed between the dorsal wall of the stomach and the subumbrella. The figure of attachment is, however, in several cases not exactly cross-shaped, but the four cross-arms meet somewhat obliquely (see Plate II, fig. 2). When seen from the mouth the cross has the appearance of four concurrent grooves. Near the centre of the stomach these grooves are open, but before they reach the corners of the stomach each of the grooves becomes transformed into a closed canal, on account of the sides of the groove being developed into two folds meeting each other from both sides, frequently after a wavy line (Plate II, figs. 2 and 3).

There are four radial canals, attached to the subumbrella by a very narrow line, straight or slightly sinuous. The distal part (2—4 mm) of each of the canals is free of gonads and communicates with the narrow circular vessel. The main part of the canal is occupied by the gonads, forming two lateral bands, provided with a number of short, rounded lateral extensions, usually 6—8 on each side of each of the canals. In fully developed individuals the breadth of the gonadial part of a radial canal is about 3 mm. The gonads commence, in well-developed specimens, at a considerable distance within the corners of the stomach, at the same point where the four dorsal grooves turn into closed canals (see Plate II, fig. 2). The gonads occupy only the dorsal part of the lateral walls of the canal; below the gonadial part there is a thin-walled part, which opens like a funnel into the corner of the stomach; this funnel-shaped part is separated from the space between the gonads by two lateral longitudinal folds, continuations of the folds along the dorsal grooves in the stomach, mentioned above (Plate II, figs. 2 and 3). At the distal end of the gonads the separation between the dorsal (gonadial) and the ventral (funnel-shaped) part is, as a rule, not complete. Microtome-sections demonstrate, that the entoderm is quite thin in the gonadial part of the wall, but much more highly developed in the walls of the funnel-shaped part; we must suppose, therefore, that the digestion of the food takes place in the latter.

The bell-margin carries a very large number of tentacles; in well-sized specimens the number amounts to about 600. In well-preserved specimens the tentacles are, usually, as long as the bell-radius; the distal end is spirally coiled. The tentacles are hollow. Tentacular bulbs are but slightly indicated, the proximal part of the tentacles being a little inflated. The ectoderm of the basal bulb is thin except on the adaxial side, where it is somewhat thickened (Plate II, figs. 5 and 6). The young tentacle issues from the proper margin of the bell and possesses an abaxial entodermal spur-like process, imbedded in the gelatinous substance on the exumbrellular side of the bell-margin (Plate II, fig. 5). During the continuous growth the adaxial side of the basal part of the tentacle grows faster than the outer side, and thereby the point of issue of the tentacle is gradually removed from the bell-margin upwards on the outer side of the bell; older tentacles, therefore, issue from the exumbrella at some distance above the bell-margin (Plate II, figs. 6 and 8). On account of this removal the abaxial part of the tentacular base, which is pushed upwards on the outer side of the umbrella, invests the spur-like process, which at last entirely disappears (Plate II, fig. 6). Accordingly, a "spur" is only present on the young tentacles. The fully developed tentacle turns abruptly outwards and downwards, immediately after leaving the wall of the umbrella. The central canal in the tentacle has not the same width everywhere, but expands and narrows at different points (Plate II, fig. 8); the greatest width is a little outside the point of issue of the tentacle. The course of the canal is approximately central, except in the basal part, where it passes the sharp bend very close to the adaxial side (Plate II, fig. 6). Within the imbedded part of the tentacular base the canal is very narrow and opens in the circular vessel. In young individuals, in which the tentacles are not so densely crowded on the bell-margin, the basal bulbs are fairly broad, all the tentacles issue from the margin itself, and spurs are only just beginning to develop.

A small, dark, sharply defined ocellus is found on the adaxial side of the base of some of the tentacles. The number of ocelli is subject to much variation; as a rule ocelli are found on every 3rd—5th of the tentacles, but they may be found on every 2nd tentacle, rarely on two successive tentacles.

Typical cordyli are situated between the tentacles (Plate II, figs. 5, 6, and 8). The cordyli issue from the bell-margin close by the base of the velum; they are very small, hardly longer than the proximal breadth of a fully-developed tentacle; they have, as a rule, a fairly thick distal part and a very thin peduncle. In some of the cordyli the inner lumen is fairly large, in others it is very narrow or nearly obliterated, being just visible as a fine streak; this variation stands in no relation to the size of the cordylus. Some of the cordyli may be mounted upon fairly large bulbi; in such cases their basal part is turning inwards (adaxially). The number of cordyli is variable and may be a little larger or a little smaller than the number of tentacles. This seems to depend on the stage of development of the individual; in full-grown specimens the number of cordyli is, probably, always the same as the number of tentacles.

The bell-margin also bears fine cirri, which may be spirally coiled, and which are greatly armoured with nematocysts in their distal part. According to Mayer the cirri are "usually somewhat less numerous than the tentacles"; in preserved material, as a rule, only a small number of cirri are left; the material, examined by me, therefore, gives no available information of their number. In badly preserved specimens I have, in fact, been unable to find any cirri at all.

The velum is fairly well-developed; in full-grown specimens it is about 3 mm wide.

The colour is subject to much variation. The manubrium, the gonads, and the tentacular bulbs may be reddish or greenish or nearly colourless. Most of the specimens, examined by me, are reddish, provided that the colour is preserved. In an individual from the "Thor" stat. 72 (1905), the gonads are pale green.

The material contains a number of young individuals, viz. from the "Michael Sars", south of the Myrdalsjøkel, Iceland, $^{17}/_{8}$ 1903; from the "Thor" stat. 45 (08), Iceland; from two localities near the Hebrides, "Thor" stat. 8 (08) and 11 (08); and from the Horns Rev light-vessel, west of Jutland, $^{23}/_{9}$ 1912. The smallest specimen is 5 mm wide. These young individuals show that the margins of the dorsal grooves in the wall of the stomach begin at an early stage to develop into folds which meet and transform a part of the groove into a closed canal; further that the gonads first appear near the corners of the stomach and, from these points, develop partly in a centripetal direction towards the centre of the stomach, which is, however, never reached, partly in an outward direction towards the circular vessel, which is, likewise, never reached. At an early stage the transversal folds of the gonads begin to form; in a specimen, 7 mm wide, each of the gonads has 2—3 pairs of transversal folds; in an individual, 9 mm wide, there are 6 pairs of folds on each of the gonads. When the diameter of the bell is about 20 mm, the gonads are somewhat far developed, particularly the female gonads, which already now contain very conspicuous eggs.

The structure, mentioned above: that the ventral, funnel-shaped part of the radial canal is separated from the dorsal gonadial part by two lateral longitudinal folds, does not seem to have been observed by previous authors. In this part of the gastro-genital system there is established a very interesting differentiation into two parts with different functions. The ventral, funnel-shaped part receives and dissolves the organisms, which serve as food for the medusa; they are however prevented from penetrating into the dorsal part between the gonads on account of the longitudinal folds; the dissolved nutritive matter, on the other hand, may pass between the folds into the dorsal part. Probably a part of the food is also digested in the stomach and may, by means of the ciliary motion in the dorsal grooves, be carried into the dorsal part of the radial canal; this part, accordingly, has two functions: to carry the gonads in its lateral walls, and to transport the nutritive substances into the peripheral parts of the canal system.

From what is said above with regard to the development of the gonads, it will be understood, that the length of the distal part of the radial canals free of gonads in proportion to the radius of the bell is considerably larger in young specimens than it is in full-grown individuals. In specimens, about 10 mm wide, the gonads reach to the middle of the radial canals. In full-grown individuals the length of the gonads is very variable. In a specimen, 28 mm wide, from Iceland ("Thor" stat. 241 (09)) the distance from the distal end of the gonads to the circular vessel is 2 mm; in another specimen, 30 mm wide ("Thor" stat. Da. 13 (04)), the length of the gonads is 9.5 mm; they commence 1.5 mm from the centre of the stomach and terminate about 4 mm from the circular vessel; in a specimen, 35 mm wide ("Thor" stat. 180 (04)), the length of the gonads is about 15 mm; they commence very near the centre of the stomach and terminate 2.5 mm from the circular vessel.

The number of tentacles is considerably larger than is usually stated in the literature. It is possible that the locality plays a part in this respect. All the specimens examined by me have been found in the waters around Scotland, the Faeroe Islands, Iceland, Norway, and Denmark. The smallest individual is from the Horns Rev light-vessel, $^{23}/_{9}$ 1912; it is 5 mm wide and has about 48 tentacles, placed at some distance from each other; in accordance herewith the basal bulbs are comparatively broad. Specimens from the waters near the Hebrides ("Thor" stat. 8 (08) and 11 (08)) have, when 7 mm wide, 100—140 tentacles, and, when 8 mm wide, 160—180 tentacles; in specimens of this size the tentacles are very closely packed on the bell-margin. The number of tentacles increases tolerably proportionally with the diameter of the individual, the average number being as follows:

Diameter of bell	11—15 mm,	230	tentacles
— —	16—20 —	290	—
— —	21—25 —	390	—
— —	26—30 —	440	—

The largest specimen examined ("Michael Sars" stat. 140 (03), east of the Orkney Islands) is 37 mm wide and has about 500 tentacles; but another specimen, 35 mm wide ("Thor" stat. 180 (04), south of Iceland) has about 620 tentacles; this is the largest number of tentacles, which I have seen in this species.

The number of ocelli is variable. There is an ocellus on, at least, every 5th of the tentacles. Even in one and the same individual the succession of the ocelli is irregular. In a specimen from Iceland ("Thor" stat. 241 (04)), about 25 mm wide, the ocelli are, on the whole, found on every second tentacle; here and there, however, two or even more successive tentacles are provided with ocelli, or ocelli are wanting on two successive tentacles. From the Hebrides ("Thor" stat. 8 (08)) we possess a number of young individuals, among others two specimens, 7 mm wide, with 100—140 tentacles; in one of these specimens the ocelli are fairly regularly distributed on every 2nd tentacle, while in the other specimen ocelli are only found on every 4th to 5th of the tentacles; among two specimens, 8 mm wide, one has an ocellus on every 2nd tentacle, in the other the ocelli are irregularly distributed on every 2nd to every 5th of the tentacles. Specimens from the same locality, 9 and 16 mm wide, have ocelli on about every 2nd tentacle. From the "Thor" stat. 11 (08), somewhat to the west of the Hebrides, we possess several specimens 8—22 mm wide; in most of these specimens there is an ocellus on every 3rd—5th of the tentacles, though in some specimens every 2nd tentacle bears an ocellus. In two specimens from the Orkney Islands ("Thor" stat. 2 (08)), 6—13 mm wide, the ocelli are fairly regularly distributed on every 5th tentacle. Most of the specimens from Iceland have ocelli on every 3rd—5th of the tentacles; in not a few cases, however, there is an ocellus on every 2nd tentacle; this is the case, for instance, in a 12 mm wide individual and in another, 25 mm wide. — It will be seen, from the facts here mentioned, that the number of ocelli stands in no ostensible relation to the size of the individual, nor to the locality, in any case as far as the area here dealt with is concerned.

The question, whether the cordyli may be transformed into tentacles, has been discussed above (p. 5). The number of cordyli has been used as a specific character, undoubtedly incorrectly. It is difficult, on preserved material, to state with certainty the number of cordyli, as they are very apt to drop off on the preservation. With regard to the material, examined by me, the fact is, that in all full-grown or nearly full-grown individuals, sufficiently well-preserved, the number of cordyli is equal to the number of tentacles. Most of the small specimens are badly preserved. In a specimen, 5 mm wide, from the Horns Rev, I have, in some cases, been able to find two cordyli between two successive tentacles.

With regard to the cirri, we may state as in the case of the cordyli: that they frequently disappear on the preservation. In most of the specimens examined by me cirri are completely absent; but in all of the well-preserved specimens a greater or smaller number of cirri are present. In no case I have been able to state the number of cirri.

The Hydroid generation belongs to the genus *Cuspidella*. As to this point, see Browne 1907, pp. 463 ff.

This medusa, fairly large and conspicuous, widely distributed, and frequently occurring in great numbers, has been known from early times, and has been described several times, usually very deficiently, unfortunately, and under many different names. It is, therefore, very difficult to give a reliable list of synonyms. The confusion has been further increased thereby that several species, belonging to quite other genera or families, have been included in the lists, e. g. by Haeckel (1879), as demonstrated by Browne (1896). Among other species, *Thaumantias* (*Cosmetira*) *pilosella* Forbes has frequently been identified with "*Laodice cruciata*", and is even found under that name in Bedot: Histoire des Hydroïdes[1]. Browne has refound the *Cosmetira pilosella* of Forbes and demonstrated, that it belongs to quite another group of Leptomedusæ.

If we want to state the correct name of the species, we must do away with all descriptions, older than 1851; they are all so vague, that the species in question cannot be identified with any probability at all.

The generic name *Laodicea* has been established by Lesson (1843) for the "*Medusa cruciata*" Forskål, called by Lesson "*Laodicea crucigera*", and this generic name has been commonly used since that time for the genus here dealt with. The first description of a *Laodicea*, sufficiently clear for identification, is the description of "*Thaumantias undulata*" Forbes and Goodsir 1851[2] from the west-coast of Scotland. When we admit that none of the forms previously described, which have later on been referred to the genus *Laodicea*, may be identified with certainty, there can be no doubt that, according to the rule of priority, the correct name of the British *Laodicea* must be *Laodicea undulata* Forbes and Goodsir. The next question is, whether there is any reason, in this particular case, to abandon the strict application of the rule, and, as Mayer (1910) prefers, "to retain an old and familiar name rather than to reinstate an unfamiliar one such as *L. undulata*". In order to answer this question, we must see, how the name of *cruciata* has been used in the subsequent period.

The name *Laodicea cruciata* was assigned by A. Agassiz (in L. Agassiz 1860—62, p. 350) to Forskål's medusa, which was, in the same work, identified with *Thaumantias mediterranea* Gegenbauer and joined together with the new species *Laodicea calcarata*, *L. cellularia* (= *Thaumantias cellularia* Haeckel 1879, *Halistaura cellularia* Bigelow 1913), and *L. stauroglypha* (an apocryphal species) to form the genus *Laodicea*. The specific name *cruciata* has not been used at all during the subsequent period until 1879, when Haeckel united several medusæ from the European Atlantic coasts and the Mediterranean under the name of "*Laodice cruciata*". As demonstrated by Browne (1896 p. 482) there is only

[1] In "Histoire des Hydroïdes" 6e période (1891 à 1900), issued 1918, Bedot has separated "*Laodicea cruciata*" from *Cosmetira pilosella*, but some of the synonyms, placed under the former, do not actually belong to that species. The "*Irene viridula*" of Garstang 1894 seems to be a real *Eirene*, with distinct stomachal peduncle and with marginal vesicles (according to Garstang's description in the quoted paper, p. 215). — "*Laodice cruciata*" of Haddon (1886 c), Garstang (1894), Herdman (1894 c), Browne (1895, 1896 c, and 1898 a) should be referred to *Cosmetira pilosella*.

[2] The paper was read before the Royal Society of Edinburgh on Jan. 20th and Febr. 3rd 1851 and printed in the Transact. Vol. XX, which was completed in 1853.

one single name among Haeckel's 25 synonyms, which really refers to a *Laodicea*, viz. *Thaumantias mediterranea* Gegenbauer. Before Haeckel, accordingly, the specific name *cruciata* was very far from being commonly used or "familiar", and Haeckel's list of synonyms made the confusion as complete as ever. Indeed, I am not able to find a better way out of the mess, than to release altogether the name of *cruciata* and follow the rule of priority, using the name by which the species has first been described in a manner which allows a recognition, viz. *undulata* Forbes and Goodsir. This was proposed by Browne in 1907, and the proposal was adopted by Vanhöffen in 1911 (p. 365).

Then we come to the question of the mutual relation between the different species of the Genus *Laodicea*.

Since new examinations of the medusæ belonging to this group have been carried out in later years (Browne 1907, Mayer 1910), it may be stated, that the Mediterranean "*Thaumantias mediterranea*", Gegenbaur, the North-American-Atlantic *Laodicea calcarata* A. Agassiz, and the Tropical-Atlantic *Laodice ulothrix* Haeckel are identical with the North-European *Laodicea undulata* (Forbes and Goodsir). Mayer is undoubtedly right, when he refers to the same species the *Laodicea marama* Agassiz and Mayer (from the Fiji Islands), a species which, according to the description (1899) is exactly like a young *undulata*. *L. indica* Browne (from Ceylon) is very like *L. undulata*, from which it is only distinguished (according to Browne 1905 b) "in having no spur at the base of the tentacles, in having larger ocelli, and perhaps in colour and size", characters to which, as will be understood from what is said above, we may hardly assign any specific importance. Cirri are present in *L. indica*, though only in small numbers.

In 1899 A. Agassiz and Mayer described a small medusa from the Fiji Islands, *Laodicea fijiana*; the most characteristic features of this species are the lacking of cirri, the very small number of cordyli, and the gonads which, in spite of the small size of the animal (6 mm), were provided with "complex diverticulæ". Tentacular spurs are not mentioned nor figured. — Maas (1905, Siboga-Exped.) describes a *Laodicea* from the Indian Archipelago and refers it to *Laodicea fijiana*, though it is much larger, being 20 mm wide; he is apt to suppose, however, that it belongs to a local variety, to which he will apply the name of var. *indica*. Browne (1907 p. 466) finds, that there is so much difference between the two forms, that it will be correct, in any case provisionally, to describe that medusa as an independent species, which he calls *L. Maasii*. As the most decisive difference Browne calls attention to the fact, that basal spurs are present on the tentacles of *L. Maasii*, whereas such are not described in *fijiana*. This, however, does not contradict the supposition, that *L. fijiana* may be a young stage of *L. maasii* (it was mentioned above that spurs are not developed in young individuals of *L. undulata* from the northern seas). The length of the gonads in *L. maasii* is highly variable; Maas writes as follows (p. 26): "... ich habe jüngere Exemplare gesehen, bei denen die Geschlechtsproducte bis an die Peripherie reichten, und alte mit strotzenden Ovarien, die nur etwa die halbe Länge der Radiärcanäle einnahmen." The length of the gonads can, accordingly, have no great importance for specific distinction. The structure of the gonads involves more difficulty. In *L. maasii* the gonads are provided with simple lateral extensions, whereas in *L. fijiana* the proximal parts of the radial canals "exhibit complex diverticulæ", on which the gonads are situated. This is only a difference in degree, it is true, which has no decisive importance; but, on the other hand, the specimens of *L. fijiana*, in any case the female individuals, seem to have contained mature sexual products, in so far as "the ova are prominent, and project outward in grape-like clusters over the surface of the genital organs". This, indeed, does not seem to suggest, that we have here to deal with young stages. It is not altogether excluded, however, that such is nevertheless the case; we know other examples, where the eggs of a still young medusa may develop into a considerable size and give the surface of the gonads a rugged appearance (see, for instance, the following pages on *Tiaropsis*). The description, given by Maas, is so clear and excellent, that it cannot be misunderstood. It may be worth while, therefore, to call attention to the fact, that Mayer (1910) identifies the two forms, an apprehension which he has not changed in his later work (1915, p. 200), after having had the opportunity of examining new material of *L. fijiana* from the Torres Straits.

During the German Deep-Sea Expedition a small *Laodicea* was found in the Gulf of Aden; it was 5 mm in diameter and had about 96 tentacles. Vanhöffen (1911) referred this medusa to *L. maasii* Browne. With regard to the size and the distribution of the large ocelli it agrees with *L. indica* Browne, but cirri could not be pointed out with certainty. On the other hand, the presence of spurs on the base of some of the tentacles evinces an agreement with *L. maasii*. It is an interesting fact, that Vanhöffen did only find spurs on the younger tentacles, whereas such were apparently absent in the case of the larger tentacles. Vanhöffen is of the opinion, "dass sämtliche Tentakel einen Sporn haben, dass er nur wegen der Krümmung des Schirmrandes häufig nicht sichtbar ist und besonders bei älteren Tentakeln undeutlich oder verdeckt wird .." (1911, p. 221). This agrees very well with what I have observed in *Laodicea undulata* (see above). Vanhöffen's medusa reminds one of the *L. bigelowi* Neppi & Stiasny (1911) from the Gulf of Triest, a small medusa (probably young), 7 mm in diameter with about 70 tentacles, some of which have basal spurs; cordyli, mounted upon small bulbs, are found in somewhat smaller number than the tentacles; cirri are wanting. There can be no doubt of the identity of this species with *Laodicea undulata*.

The three forms of *Laodicea* from the Indo-Pacific region, mentioned above, viz. *fijiana*, *maasii*, and *indica*, are undoubtedly nearly related. Their relation to the European *Laodicea undulata* may, most adequately, be elucidated through a comparison between the latter and Maas's excellent description of "*L. fijiana* var. *indica*" (= *maasii* Browne). The description and figure (Taf. V, Fig. 34) of the flattened, open, square stomach, the four corners of which are drawn out into four "Zipfel", agree exactly with the features found in *L. undulata*. The same holds good with regard to the gonads, which, in the case of the North-Atlantic forms, have not been sufficiently thoroughly described up to now. Maas mentions "Aussackungen, die nicht allein durch Faltung des die Geschlechtsprodukte tragenden Ectoderms bedingt sind, sondern auch durch entsprechende Aussackungen des entodermalen Raumes". Also in this respect we find a complete agreement with the facts, as I have observed them in *undulata*. The length of the gonads is, in *L. maasii*, very variable, being, as a rule, $^2/_3$ the length of the radial canal, but, in some cases, reaching nearly to the circular vessel. The number of tentacles seems to be somewhat smaller in *L. maasii* than in equally-sized individuals of *L. undulata*; in this regard *maasii* is more in accordance with *calcarata* and *ulothrix*. The shape of the tentacles is exactly as in *undulata*. Ocelli are said to be found on about three-fourth of the tentacles of *maasii*; in *undulata* the number of ocelli is, as mentioned above, very variable. *L. maasii* is said to possess a comparatively small number of cordyli; the highly irregular distribution of the cordyli, however, seems to indicate, that the number has been greater in the living animal, but that most of the cordyli have dropped off, as is often the case in preserved material. — Cirri have not been observed in *L. maasii*; it is possible, that cirri are really wanting in this form, but, on the other hand, there is an equal probability of the want being due to the preservation. As mentioned above, cirri were only ostensible in well-preserved specimens of *L. undulata*, and even then but a very small number were left; moreover, it is always very difficult to trace these delicate organs between the densely crowded tentacles. Also the above-mentioned *L. bigelowi* Neppi & Stiasny is said to be devoid of cirri, though its identity with the common European form is beyond doubt. The colour of the radial canals, the gonads etc. of *L. maasii* is light blue to bluish-green, thus particularly in accordance with the colour commonly found in *L. ulothrix*, a colour which may also be met with in others of the Atlantic forms of *Laodicea*. — Altogether, the description, as given by Maas, of the East-Indian medusa presents a correspondence, accomplished into minute details, with *Laodicea undulata* from the north-eastern Atlantic, the only feature of distinction being the want of cirri, a feature which, very probably, is due to preservation.

We still have to mention *Laodicea pulchra* Browne (1902, p. 280) from the Falkland Islands. This medusa grows to the size of 25 mm in diameter; in spite of this considerable size it has only about 50 tentacles; there are usually 3—4 cordyli between each successive pair of tentacles. This is evidently a well-defined form, specifically different from all the forms mentioned above.

Table II. Synoptic Table of the various forms of Laodicea.

Name	Occurrence	Size	Cirri	Basal Spurs	Colour
undulata	N.-Atlantic, Europe	large, up to 37 mm	present	present on the younger tentacles	usually reddish or orange, may be brownish, purple, blue or violet
mediterranea	Mediterranean	not stated	present	present	brownish-reddish
bigelowi	Mediterranean	7 mm	absent	present	not stated
calcarata	N.-Atlantic, America	large	present	present	usually dark-yellowish, but very variable, reddish, greenish, or blue
ulothrix	Tropical Atlantic	fairly large	present	present, but not on all tentacles	brownish-white, greenish-white
marama	Fiji Islands	5.5 mm	present	not mentioned	bluish or greenish
fijiana	Fiji Islands, Torres Straits	up to 10 mm	absent	not mentioned	bluish, greenish, or violet
maasii (acc. to Maas)	Malayan Archipelago	up to 20 mm	absent	present on several tentacles	light blue or bluish-green
indica (Browne)	Ceylon	up to 6 mm	present	absent	not stated
maasii (acc. to Vanh.)	Gulf of Aden	5 mm	not stated	present	not stated

The Table II includes all the different forms of *Laodicea* described up to now (except *L. pulchra*), arranged according to their geographical occurrence. It will be seen that all of the forms from the Atlantic-Mediterranean area possess both cirri and tentacular spurs, with the exception of *L. bigelowi* from the Adriatic Sea, in which cirri have not been observed. With regard to the forms from the Indo-Pacific region, the organs in question are said to occur in some forms, whereas they are wanting in others. The predominant colours of the gastro-genital organs are bluish or greenish in the Indo-Pacific forms as also in the Tropical-Atlantic form, whereas the reddish, yellowish, or brownish colours are predominant in the North-Atlantic forms; blue, green, and violet may, however, also be met with in the latter.

I am inclined to suppose, that all the forms of *Laodicea* described up to now, with the exception of *Laodicea pulchra* Browne, belong to one and the same species: *Laodicea undulata* Forbes and Goodsir, a species which attains its most exuberant development in the North-Atlantic; in the tropical Atlantic, the tropical Pacific, and the Indian Ocean the species is represented by forms, which may be called more or less well-marked local varieties; in some cases the described differences from the typical *L. undulata* may even possibly be due to bad preservation.

If this view be correct, the Geographical Distribution of *Laodicea undulata* is the following:

1) *Atlantic Coasts of Northern Europe.* — (*L. undulata* Forbes and Goodsir). — The occurrence within this area will be discussed in a more detailed way further below.

2) *Mediterranean.* — Neapel, "occasionally during the winter of 1907—08" (*L. cruciata*, Mayer 1910). Messina, winter 1852—1853 (*Thaumantias mediterranea*, Gegenbauer 1856). Triest (*L. cruciata*, Graeffe 1884, *L. bigelowi*, Neppi & Stiasny 1911). Villafranca (*L. cruciata*, Metschnikoff 1886).

3) *Atlantic Coasts of North-America*, south of Cape Cod (*L. calcarata* A. Agassiz). — Naushon, Vineyard Sound, between Delaware Bay and Chesapeake Bay, Woods Hole (A. Agassiz 1865, Hargitt 1904, Mayer 1910, Bigelow 1914b and 1915). — During the numerous investigations of the "Grampus" in the Massachusetts Bay *Laodicea* was never found. During the investigations in July and August 1913, ranging from Nova Scotia to Chesapeake Bay (Lat. about $44^1/_2°$ to 37° N.) the species was found at four of the southernmost stations, between Delaware Bay and Chesapeake Bay (i. e. Lat. 37° to 38°26′ N.) at the end of July (Bigelow 1915, p. 318 and the list p. 316—317).

4) *Tropical Atlantic* (*L. ulothrix* Haeckel). — Canary Islands (Haeckel 1879, Vanhöffen 1912). Bahamas (Mayer 1904). Tortugas, Florida, common during the summer-months (Mayer 1900).

5) *Fiji Islands*, common in December (*L. fijiana* and *marama*, Agassiz and Mayer 1899).

6) *Torres Straits*, September—October (*L. fijiana*, Mayer 1915).

7) *North-Coast of New Guinea and several places in the Malayan-Archipelago* (*L. fijiana* var. *indica*, Maas 1905, *L. maasii*, Browne 1907).

8) *West-Coast of Ceylon* (*L. indica*, Browne 1905).

9) *Gulf of Aden* (*L. maasii*, Vanhöffen 1911).

All records agree, that this species occurs exclusively in the neighbourhood of the coasts.

Distribution and Occurrence in the north-eastern Atlantic.

The material at my disposal has been collected at 28 different localities, which are here mentioned in the following order: the waters south of Iceland, round Rockall, west, north, and east of Scotland, North-Sea, Skagerrak. (See Chart II p. 26.)

1) — Lat. 64°06′ N., Long. 23°14′ W., Faxebugt, Iceland. July 2nd 1908. Depth 98 m. Young-fish trawl, 65 m wire. "Thor" stat. 45 (08). — 1 specimen, 12 mm wide.

2) — South of Myrdalsjökel, Iceland. August 17th 1903. "Michael Sars". — 1 specimen, 17 mm wide.

3) — Myri Bugt, Iceland. July 21st 1904. Depth 38 m. "Beskytteren". — 6 specimens, 21—26 mm wide.

4) — Lat. 64°04′ N., Long. 15°48′ W., Myri Bugt. July 24th 1904. "Beskytteren". — 2 specimens, 18—22 mm wide.

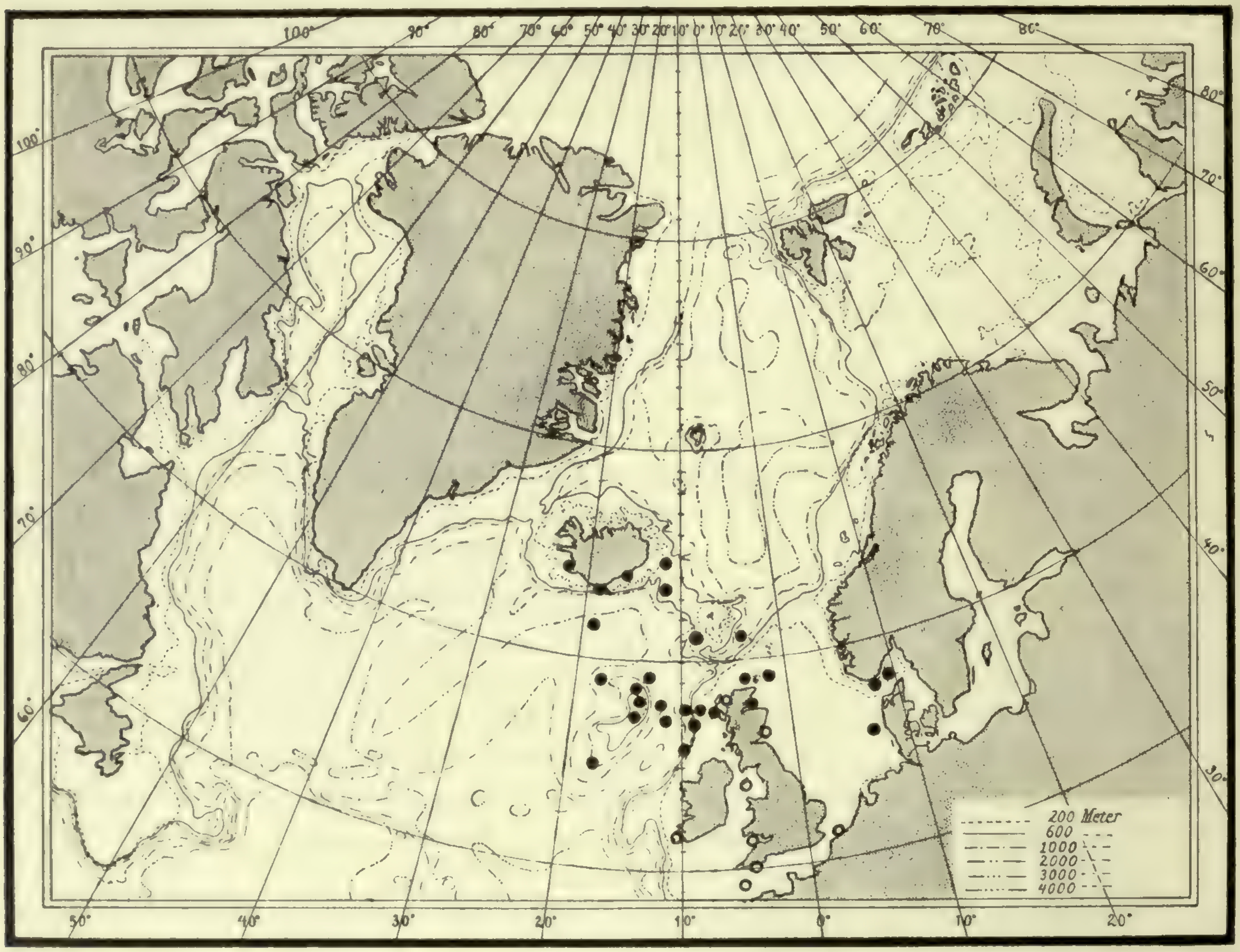


Chart II. Occurrence of *Laodicea undulata* in the northern Atlantic and adjacent waters.
○ Occurrence according to the literature.

5) — Lat. 64°35′ N., Long. 11°45′ W., East-Iceland. August 8th 1904. Depth 348 m. Young-fish trawl, 20 or 70 m wire. "Thor" stat. 241 (04). — 2 specimens, 25—28 mm wide.

6) — Lat. 61°34′ N., Long. 19°05′ W., south of Iceland. July 10th 1904. Depth 2160 m. Young-fish trawl, 15 or 70 m wire. "Thor" stat. 180 (04). — 1 specimen, 35 mm wide.

7) — Lat. 63°12′ N., Long. 11°45′ W., between Iceland and the Faeroe Islands. August 7th 1904. Young-fish trawl, 20 m wire. "Thor" stat. Da 13. — 1 specimen, 30 mm wide.

8) — Lat. 59° N., Long. 18° W., between Iceland and Rockall. Olrik. — 3 specimens, 22—28 mm wide.

9) — Lat. 59°07′ N., Long. 13°32′ W., north of Rockall. Moberg. — 5 specimens, 14 — about 25 mm wide.

10) — Lat. 58—59° N., Long. 13—15° W., north of Rockall. Rink 1852. — 5 specimens, about 22 mm wide.

11) — Lat. 57°45′ N., Long. 13°40′ W., near Rockall. August 6th 1910. Young-fish trawl, 50 m wire. "Michael Sars" stat. 99 (10). — 5 or 7 specimens.

12) — Lat. 56°58′ N., Long. 14°39′ W., Rockall Bank. July 7th 1913. "Armauer Hansen" stat. 2. — 200 m wire: 4 large specimens, up to 33 mm wide. — 400 m wire: 1 large specimen.

13) — Lat. 54°42′ N., Long. 18°44′ W., south-west end of Rockall Plateau. July 10th 1913. "Armauer Hansen" stat. 4. — 400 m wire: 3 specimens, two very large, one smaller. — 600 m wire: 1 specimen. — 1000 m wire: 4 large specimens.

14) — East of Rockall. July 28th 1913. "Armauer Hansen" stat. 17. — Surface: 9 full-grown specimens. — 150 m wire: 3 specimens, two very large, one smaller. — 600 m wire: 4 specimens, three large, one smaller. — 1000 m wire: 3 large specimens. — 1300 m wire: 7 specimens, among which are 5 very large, being up to 35 mm wide.

15) Lat. 57°03′ N., Long. 11°20′ W., deep channel east of Rockall, May 28th 1908. Young-fish trawl, 300 m wire. "Thor" stat. 12 (08). — 1 specimen, 26 mm wide.

16) Lat. 55°44′ N., Long. 9°35′ W., north-west of Ireland. June 25th 1906. Depth 1600 m. Young-fish trawl, 350 m wire. "Thor" stat. 89 (06). — 1 specimen, 26 mm wide.

17) — Lat. 57°52′ N., Long. 9°53′ W., deep channel east of Rockall. June 8th 1905. Young-fish trawl, 600 m wire. "Thor" stat. 72 (05). — 1 specimen, about 23 mm wide.

18) — Lat. 56°56′ N., 9°01′ W., west of Scotland. May 28th 1908. Depth 140 m. Young-fish trawl, 65 m wire. "Thor" stat. 11 (08). — 9 specimens, 8—22 mm wide (8, 11, 13, 14, 14, 16, 21, 21, 22 mm).

19) — Near St. Kilda. July 5th 1913. "Armauer Hansen" stat. 1. — Surface: 1 specimen. — 50 m wire: 1 specimen.

20) — Lat. 57°36′ N., Long. 7°05′ W., Little Minch. May 27th 1908. Depth 90 m. Young-fish trawl, 65 m wire. "Thor" stat. 8 (08). — 7 specimens, 7—16 mm wide (7, 7, 8, 8, 9, 11, 16 mm).

21) — Lat. 59°00′ N., Long. 3°34′ W., west of Orkney Islands. May 21st 1908. Depth 66 m. Young-fish trawl, surface. "Thor" stat. 2 (08). — 2 specimens, 6—13 mm wide.

22) — Lat. 60°55′ N., Long. 8°56′ W., Faeroe Bank. August 12th 1902. Depth 130 m. "Michael Sars" stat. 78 (02). — 1 specimen, about 15 mm wide.

23) — Lat. 61°04′ N., Long. 4°33′ W., Faeroe-Shetland channel. July 23rd 1905. Depth 1075 m. Young-fish trawl, 1000 m wire. "Thor" stat. 124 (05). — 1 specimen, about 26 mm wide.

24) — East of Orkney Islands. June 26th 1903. "Michael Sars" stat. 140 (03). — 8 specimens, 25—37 mm wide (25, 30, 30, 33, 33, 33, 35, 37 mm).

25) — Murray Firth. September 4th—5th 1904. "Thor". — 1 specimen, 23 mm wide.

26) — Horns Rev lightvessel, west coast of Jutland. September 23rd 1912. Depth 30 m. Vertical haul, 30—0 m. — 1 specimen, 5 mm wide with about 48 tentacles.

27) — 18 miles south of Oxö lighthouse, Skagerrak. May 28th 1907. Depth 510 m. "Thor" stat. 1074. — 2 specimens. (Plankton Laboratory, Copenhagen).

28) — 12 miles NW. $^3/_4$ W. of Hirshals lighthouse, Skagerrak. October 9th 1904. Depth 640 m. Young-fish trawl, in intermediate strata. "Thor" stat. 273. — 7 specimens. (Plankton Laboratory, Copenhagen).

The specimens from the "Michael Sars" 1910 and the "Armauer Hansen" are in Bergens Museum, the specimens from the "Thor" stat. 273 and 1074 are in the collection of the Plankton Laboratory in Copenhagen; the other specimens are all in the Zoological Museum of Copenhagen.

The information, given in the literature, on the occurrence of *Laodicea undulata* in the North Atlantic area are rather few and scattered and, moreover, not always reliable, in so far as the species has frequently been confounded with *Cosmetira pilosella* Forbes.

The type-specimens of Forbes and Goodsir were found in the Minch between Scotland and the Hebrides "on a very warm day, when the sea was very calm ...".

"*Laodice cruciata* (*Thaumantias pilosella* Forbes)" has been recorded from St. Andrews Bay by McIntosh (1888) and by Crawford (1891) who states, that it "swarmed throughout August and continued in diminishing numbers till November". After recording the species under the name quoted above, the latter author adds: "with marginal cirri and clubs". This seems to show, that the recorded species is really *Laodicea undulata* and not *Cosmetira pilosella.*

During the investigations of Browne in the Firth of Clyde 1901—02 *Laodicea undulata* was not found.

According to Browne (1900, p. 720) the species has been found several times in the neighbourhood of Valencia Harbour, Ireland. In 1895 it was found in April and July, in 1896 from July to the beginning of September; in 1897 it appeared in May and was fairly common in August and September and again in November, whereafter it disappeared. In 1898 it was found from June to November and was very abundant during July and August. Browne adds: "This species has not often been recorded in British seas". In the paper here quoted Browne calls the species with the name of *L. calcarata.* — It was also at Valencia Harbour that Miss Delap succeeded in rearing *Laodicea* from the Hydroid *Cuspidella costata* Hincks, in June 1906 (Browne 1907, p. 464).

The medusa recorded by Browne 1895 (Report on the Medusæ of the L. M. B. C. District) as "*Laodice cruciata*" belongs to *Cosmetira pilosella* Forbes. But in the same paper (p. 276) is mentioned a specimen of "*Laodice calcarata* L. Agassiz", found at Port Erin on May 5th 1894, a young specimen, 5 mm in diameter "... with about 30 tentacles, and cirri of both shapes" (i. e. filiform cirri and cordyli). "It corresponds to the description given by Agassiz". This medusa has, undoubtedly, been a *Laodicea undulata*, which species may, accordingly, be found at Port Erin.

From Plymouth "*Laodice cruciata*" has been mentioned by Garstang (1894, p. 215), but also in this case the medusa in question has actually been *Cosmetira pilosella* Forbes. Browne (1897 b) gives a list of medusæ, found at Plymouth during September 1893, 1895, and 1897. *Laodicea* is not mentioned in that list. Neither is it recorded in the "Plymouth Marine Invertebrate Fauna" 1904, whereas "*Euchilota pilosella* (Forbes)" is said to be common every summer in the neighbourhood of Plymouth.

Nevertheless, *Laodicea undulata* actually occurs in the British Channel. In the British Museum of Natural History in London I have seen two specimens from Plymouth, and it is recorded from the

Channel (under the name of *Laodice calcarata*) in the International Plankton Catalogues (Catalogue, 1906, 1909, and 1916). We have to be very cautious, it is true, in employing these catalogues, as the identifications of the species have, as a rule, not been made by specialists; in the present case, however, I believe the identification to be correct. In one particular instant I have been able to verify the identification directly, some specimens being present in the type collection of the plankton laboratory in Copenhagen. — During the years from 1903 to 1908 the species has been taken in the Channel almost every year in the month of August, and sometimes also in May; only once it was found in November (1905). It was found in the Bristol Channel in August 1905, 1906, and 1907, and in May 1908. It has also on one occasion been found in the North Sea off the coast of Belgium, viz. in August 1905.

As far as I am aware, *Laodicea undulata* has never been recorded from the east coast of Great Britain south of St. Andrews.

Neither has it been mentioned from Heligoland.

I have worked through a very considerable material of plankton from the Horns Rev light-vessel off the southern part of the west coast of Jutland, but I have only found one single, small specimen of this species.

It seems also to be scarce in the Skagerrak, in so far as it has only been observed twice in that sea; it does not penetrate into the Kattegat.

I have never seen this species recorded from the west coast of Norway, and it seems, on the whole, to be altogether lacking in the Norwegian Sea[1].

Nor is it known to occur off the Atlantic coasts of Europe south of the British Channel.

If we compare the records of the literature with the data derived from the material examined by me, we will gain the following general picture of the horizontal distribution of *Laodicea undulata* in the North-East Atlantic area: The species occurs off the southern coasts of Iceland, is numerous around the Rockall plateau and Scotland; it is also found, though apparently in smaller quantities, off the western coasts of Ireland and England, in the Channel, and in the south-western part of the North Sea. Finally it may be found, occasionally, off the western and northern coasts of Jutland.

All records agree, that this species does not occur in any great distance from the coasts, that the distance from the shore, accordingly, sets a limit to the horizontal distribution. On the other hand, the actual depth is without importance with regard to the occurrence. Some of the specimens here dealt with have been taken in shallow water near the coasts or above the Rockall Bank, others have been found above very deep water, as for instance on the "Thor" stat. 180 (04), where the depth was 2160 m, and several specimens have been found in the Rockall Channel, the Faeroe-Shetland Channel, and the Norwegian Channel.

With regard to the vertical distribution we will find, that the species may occur in very different depths below the surface, it having been found in all strata between the surface and about 800 m below the surface. The results of the cruise of the "Armauer Hansen" in 1913 are particularly instructive with regard to the occurrence of this species. *Laodicea undulata* was lacking on all of the

[1]) Hartlaub (1900, p. 172) mentions numerous specimens "der schönen, scheinbar magenlosen *Laodice cruciata*", found during the expedition of the "Olga" at Tromsö (northern Norway) on June 28th 1898. If the identification be correct, we have here an isolated find of high interest.

western stations of this expedition, these stations being situated too far from land; on the other hand, it was found on all of the eastern stations, stat. 1, 2, 4, and 17. But in these localities, all in comparatively short distance from land, the species was found down to the very greatest depths, in which hauls were made, and by no means in small numbers. Particularly interesting is the station 17 in the deep channel between Rockall and Scotland; at this station 9 specimens were taken at the surface, 7 specimens in about 800 m depth, and a number of specimens about 100, 400, and 650 m below the surface. On this locality, accordingly, the species was fairly common in all strata, at least as far down as about 800 m below the surface.

Young specimens are, however, found in the upper water layers exclusively, whereas large and middle-sized individuals may be met with in all depths. In the material at my disposal young individuals are present from the following localities:

Loc. Nr. 1. "Thor" stat. 45 (08). July 2nd 1908. Surface. — 1 specimen, 12 mm.
— - 18. — — 11 (08). May 28th 1908. About 40 m depth. — 9 specimens, 8—22 mm.
— - 20. — — 8 (08). May 27th 1908. About 40 m depth. — 7 specimens, 7—16 mm.
— - 21. — — 2 (08). May 21st 1908. Surface. — 2 specimens, 6—13 mm.
— - 26. Horns Rev. September 23rd 1912. 30—0 m. — 1 specimen, 5 mm.

These localities are all situated very near land. It will be observed, moreover, that most of the young specimens have been found at the end of May; one specimen was taken at the beginning of July in Faxebugt on the west coast of Iceland, and one specimen, the smallest which I have seen, was found in September off the west coast of Jutland. — Larger individuals may also be met with early in the year. Thus on May 28th 1908 (Loc. Nr. 15) a specimen, 26 mm wide, was found in about 200 m depth, and the very largest among the specimens observed, 37 mm wide, was found together with 7 other specimens on June 26th 1903 east of the Orkney Islands ("Michael Sars" stat. 140 (03), depth not stated). Most of the large specimens were, however, taken in July and August. This agrees very well with the statements in the literature. According to these the species appears off the British coasts in May, more seldom in April (Valencia Harbour, Browne 1900), is common during the summer months, and disappears in October or November. The material, examined by me, gives no information as to how late in the autumn the species may be met with in the area investigated, because none of the expeditions, the material of which has been at my disposal, has worked in these regions later than in October, most of them only during the summer months.

According to the above statements *Laodicea undulata* is, in the North-East Atlantic area, a summer form, deliberated from the littoral hydroid *Cuspidella* in the spring or the first summer months, reaching its full size in the warm months, and disappearing in the late autumn, after having accomplished its breeding season; probably the planula larvæ attach themselves in the autumn and develop into the hydroid *Cuspidella*, which passes the winter and sends out its medusa generation in the next spring.

Also off the east coast of North America *Laodicea undulata* is a summer form, occurring from June to the beginning of the winter, being most frequent in July and August. — In the Mediterranean, on the other hand, it is found during the winter.

Genus **Ptychogena** A. Agassiz.

Ptychogena lactea A. Agassiz.

Plate III, figs. 1—6. Textfig. 5.

Ptychogena lactea A. Agassiz 1865. North American Acalephæ, p. 137, figs. 220—224.
— — Haeckel 1879. System der Medusen, p. 147.
— *pinnulata* Haeckel 1879. ibid. p. 148.
— — — 1881. Tiefsee-Medusen der Challenger-Reise, p. 6. Taf. II.
— *lactea* A. Agassiz 1888. Bull. Mus. Comp. Zool. Harvard Coll. Vol. XV, p. 128.
— *pinnulata* Levinsen 1892. Meduser etc. fra Grønlands Vestkyst. — Vidensk. Meddel. Naturhist. Foren., 1892, p. 145.
— — Aurivillius 1896. Plankton der Baffins Bay und Davis' Strait. — Festskr. Wilh. Lilljeborg tillegnad, p. 198.
— *lactea* Vanhöffen 1897. Fauna und Flora Grönlands. — Drygalski's Grönland-Exped. Bd. II, p. 273.
— *pinnulata* Grönberg 1898. Hydroid-Medusen des arktischen Gebiets. — Zool. Jahrb. Bd. XI, p. 465.
— — var. Linko 1904 b. Zool. Studien im Barents-Meere. — Zool. Anz. Bd. XXVIII, p. 217.
— *lactea* Browne 1907. Revision of the Laodiceidæ. — Ann. Mag. Nat. Hist. Ser. 7. Vol. XX, p. 473.
— — Mayer 1910. Medusæ of the World, p. 215.
— — Bigelow 1913. Medusae ... N. W. Pacific. — Proceed. U. S. Nat. Mus. Vol. 44, p. 28.
— — Kramp 1913. Medusæ ... "Tjalfe" Exped. — Vidensk. Meddel. Dansk Naturhist. Foren. Bd. 65, p. 268.
— — 1914. Conspectus Faunæ Groenlandicæ, p. 422.

Description of a full-grown specimen from the south coast of Disco, Greenland, "Tjalfe" Exped. stat. 125.

Diameter (the specimen is preserved in alcohol) about 90 mm, height of the bell about 30 mm. The gelatinous substance is very thick, 10 mm at the apical point; the thickness is almost equal throughout the greater part of the bell; only in the peripheral part, within a short distance from the bell-margin, it is evenly diminishing towards the latter. The stomach is quadrate, attached to the subumbrella along the arms of a perradial cross, so that there are four interradial, triangular pouches between the dorsal wall of the stomach and the subumbrella. The length of the sides of the stomach is 20 mm. The prismatic mouth-tube is short, hardly 10 mm long. The mouth-opening is quadrate; the four perradial corners are dilatated into four quite short lips. The mouth-edge is faintly folded. The perradial cross, mentioned above, along the arms of which the stomach is attached to the subumbrella, is seen on the inner side of the dorsal wall of the stomach as four ciliated grooves; in this specimen the grooves do not meet exactly in the centre (see Plate III, fig. 1); the grooves are centripetal continuations of the dorsal wall of the radial canals. The proximal two-thirds of the 4 radial canals are funnel-shaped, with a wide opening into the corners of the stomach; the distal one-third of the radial canal is a narrow tube, communicating with the narrow circular vessel. The umbrellular part of the funnel-shaped canal is narrow, and from this part issue a large number of lateral folds or branches, perpendicular to the main canal. The umbrellular walls of these lateral folds are attached to the subumbrella, whence the folds hang as perpendicular lamellæ, the ventral edges being free. Below the narrow, lamelliferous part of the radial canal is the wide, funnel-shaped part, mentioned above, reaching outwards nearly to the outermost (distal) lateral folds, gradually narrowing outwards and terminating in a point. The narrow dorsal part is separated from the wide ventral part by a longitudinal fold on each side (Plate III, figs. 2 and 3). These two folds continue in a centripetal direction in the dorsal wall of the stomach nearly to the centre along both sides of each of the ciliated grooves (Plate III, fig. 1). Towards the distal end of the funnel-shaped part the folds are gradually tapering; in the distal part of the folding system there is, accordingly, no complete separation between the ventral and the dorsal part of the canal. Thus a differentiation of the gastro-vascular system, similar to that in *Laodicea undulata*, is established in this species. Probably the food is received and dissolved in the wider, ventral part (I have found half-digested copepods therein); the dorsal part only communicates with the ventral part for a short distance near the distal end of the funnel-shaped part. Proximally the dorsal part opens into the dorsal wall of the stomach through a narrow opening, distally it passes into the narrow, tube-shaped part of the radial canal, free of gonads, through which the dissolved nutritive substances, which have been carried from the funnel-shaped part into the dorsal part, are transported further into the circular vessel.

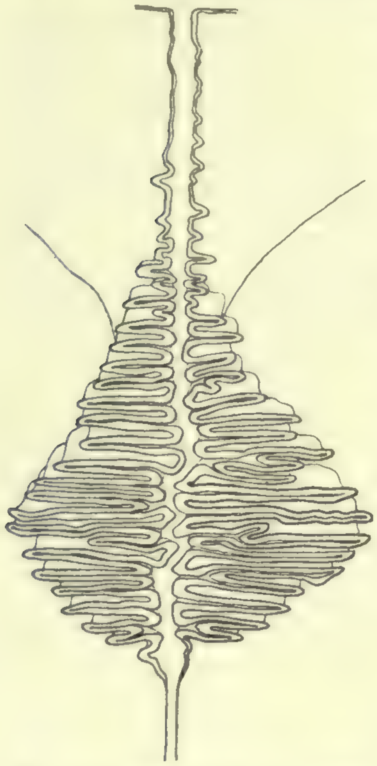


Fig. 5. *Ptychogena lactea* A. Agassiz. A radial canal with its branches and gonads, seen from the apical side. — From a specimen from Ritenbenk, Greenland.

Seen from the aboral side the systems of transversal folds form together four elliptical figures, commencing at a short distance from the corners of the stomach. In the present specimen the length of the elliptical figures is about 24 mm, the largest breadth about 19 mm, the longest (middle) of the lateral branches being about 9 mm long, perpendicularly to the main canal. Within this part of the radial canals there are altogether 20—25 folds on each side of the main canal. Besides these closely set folds there are some short, isolated folds in the lateral walls of the grooves in the dorsal wall of the stomach (see textfig. 5, which has been drawn from another specimen). Each of the lateral branches of the radial canals has the shape of a flat, perpendicularly placed pouch, the dorsal edge of which is attached to the subumbrella along a narrow line, and which opens into the main canal by a perpendicular fissure in the narrow, dorsal part of the canal (Plate III, fig. 4). In the walls of these pouches the gonads are developed. The gonads (Plate III, fig. 5) surround the pouch completely except in the line, by which the latter is attached to the subumbrella. Thus the gonads on the two sides of the pouch communicate around the free (ventral and distal) edges of the pouch. Moreover the gonads of two successive pouches communicate proximally in the perpendicular edge between the openings of the two pouches into the main canal. Accordingly, each of the four radial canals of the medusa has actually only two gonadial bands, separated in the median line of the canal, but each of these bands is folded in a complicated manner. The free edge of each of the pouches gives rise to a row of papillæ of different length (Plate III, fig. 2). The papillæ are hollow; they are extensions from the lateral branches of the radial canal, and their lumen communicates with the lumen of the latter (Plate III, fig. 5). The papillæ are more closely set in the distal part of each of the lamellæ; in the middle part they are more dispersed, and in the proximal part the edge of the lamella is smooth (Plate III, fig. 2). On the shorter (younger) lamellæ the smooth part is comparatively long, only a few papillæ being present, and these are distally situated; on the longest (oldest) lamellæ the smooth part is quite short; on the quite young lamellæ no papillæ are found, the edge is quite smooth. — The oldest lamellæ are in the middle part of the system; the proximal and the distal lamellæ are the younger. New lamellæ are formed, however, not merely proximally and distally, but also intermediary between the older lamellæ in any spare room in the system. — The side-walls of the lamellæ are, as a rule, not quite plane, but are more or less uneven. We may even, occasionally, find a secondary branch, forming an acute angle with the mother-branch. — In the present specimen the ventral, funnel-shaped part of the radial canals reaches nearly to the distal end of the folded system.

The bell margin carries a large number of tentacles and cordyli. In the present specimen there are 400—500 tentacles. Each of the tentacles has a somewhat compressed bulb, about 2.5 mm long; this bulb is somewhat broader distally than proximally. Its outer (abaxial) edge is convex, the inner (adaxial) edge is straight or faintly concave (Plate III, fig. 6). The distal end of the bulbus bends sharply inwards (adaxially) at the point of transition into the thread-like part of the tentacle; very soon the latter bends sharply outwards. The tentacular bulb is hollow; its lumen opens like a funnel into the circular vessel. On the abaxial side of the basal part of the bulb there is a short, conical protuberance (a rudimentary tentacular spur) extending into the gelatinous substance of the exumbrella (Plate III, fig. 6). — The cordyli are small; in the present specimen they are about $^1/_6$ the length of the tentacular bulbs. They alternate fairly regularly with the tentacles, forming a row a little inside the row of tentacles. Each of the cordyli has the shape of a lengthened club, mounted upon a small tubercle closely outside the base of the velum. The cordyli are hollow, but their lumen is very narrow, and in fully developed cordyli it is apparently always separated from the circular vessel, the lumen of the peduncle being quite obliterated. — This specimen seems to represent the fully developed stage of growth, in so far as the tentacular bulbs are all of equal size, and the cordyli alternate with the tentacles and are all situated on small tubercles.

The velum is well developed but weak.

As far as I am aware, this individual is the largest specimen of *Ptychogena lactea* hitherto described. In younger individuals there are a smaller number of lateral folds on the radial canals, and the free edges of the lamellæ carry a smaller number of papillæ; in specimens, less than about 35 mm in diameter, the edges are quite smooth. In younger specimens the funnel-shaped extensions of the corners of the stomach do not reach the distal ends of the gonadial part of the radial canals. The lateral folds, which separate the dorsal part of the radial canal from the ventral part, are not developed in young individuals. The secondary branching of the lateral branches of the radial canals seems to be a feature of individual variation with no relation to the developmental stage of the specimen.

The smallest specimen, which I have examined, was found near Jakobshavn in Greenland. It is 14 mm in diameter. The state of preservation is not good, especially the stomach is much destroyed. The bell seems to have been comparatively higher than in grown-up individuals; in the present condition of the specimen the height is 8 mm. The length of the folded parts of the radial canals is about 3.5 mm, the largest breadth about 2—2.5 mm. In each of the folding systems 5—6 pairs of lateral folds are present; they confirm the above statement, that new lateral branches are developed not only proximally and distally, but also intermediary; there are no secondary branches. The free margins of

Table III. Synopsis of the specimens of *Ptychogena lactea* examined.

Locality No.	Diameter of specimen	Height of specimen	Sides of the stomach	Distance from the centre to the beginning of the closely-folded part	Length of the closely-folded part	Largest breadth of the closely-folded part	Number of primary folds in the closely-folded part	Length of the distal part of the radial canals, free of gonads	Number of tentacles	Number of cordyli	Remarks
	mm	mm	mm	mm	mm	mm		mm			
3	90	30	20	11	25	19	40—50	10	400—450	same number as tentacles	Lamellæ with papillæ, a few with secondary branching.
—	70	..	14	11	13—15	13	37—43	13—14	...	..	Largest lamellæ with about 15 papillæ, no secondary branching.
2	68	..	..	..	14—16	12—13	41—49	...	...	...	Lamellæ with as many as 5—6 papillæ; secondary branching.
1	50	..	11	10	10—12	8—9	25—28	...	...	...	Papillæ present; secondary branching. One of the radial canals abnormal, its dimensions not included in the table.
7	40	..	..	..	...	...	...	...	...	...	Secondary branching. Fairly long papillæ.
9	35	20	..	..	8	7.5	about 25	7	...	about equal to number of tentacles	Edges of lamellæ smooth; secondary branching of a few lamellæ. Only one gonadial system measured.
4	14	8	..	..	3.5	2—2.5	10—12	2—3	60—80	more numerous than tentacles	No papillæ; no secondary branching.

the lamellæ are smooth. The length of the distal part of the radial canals, free of gonads, is 2—3 mm. The number of tentacles cannot be stated exactly, but there are about 15—20 tentacles in each quadrant. The cordyli are somewhat more numerous than the tentacles (compare Bigelow 1913, who states that there is a comparatively larger number of cordyli in young specimens than in older ones). Some of the cordyli are situated on quite small tubercles as in the large individual, but some others are mounted upon large, thick bulbs, very like tentacular bulbs of half size; still others are placed in a manner intermediary between these two extremes.

In order to illustrate the variation and development of the species I have worked up the above synoptic table (Table III) of the specimens examined by me. — Most of the specimens are badly preserved, so that especially the number of tentacles cannot be stated. As will be seen from the synopsis, the shape of the folded part of the radial canals is subject to much variation; it may be nearly circular in outline, as in the specimen from the Kara Sea (locality No. 9) and the 70 mm wide specimen from the "Tjalfe" stat. 125, or it may be more lengthened, elliptical.

From the "Tjalfe" stat. 171 we have a specimen, 50 mm wide, in which the canal system is abnormally developed. One of the radial canals is bifurcate proximally near its point of issue from the stomach. Each of the two branches has its own system of lateral branches and gonads, and the two systems do not touch each other. The one system is somewhat smaller than the other and diverge somewhat more from the perradial direction. This "secondary" canal has, probably, not reached to the circular vessel; this cannot, however, be stated with certainty. The gonads in the "secondary" system are on the same stage of development as the others, though the lamellæ are somewhat shorter. Another radial canal in the same specimen is bifurcated distally. The folded gonadial part has nearly the normal shape, but the distal end of this part gives rise to two narrow, divergent canals, running to the circular vessel. One of the lateral branches of this gonadial system is twice dichotomically branched.

It has been acknowledged long ago, that the difference between *Ptychogena lactea* Agassiz and *Ptychogena pinnulata* Haeckel depends on development and variation. Haeckel's description is based on two specimens from the Atlantic north of Rockall and a fragment of a specimen, found by the "Challenger" expedition in the neighbourhood of Halifax. The two first mentioned specimens are in the Zoological Museum of Copenhagen; thus I have been able to examine these specimens. Haeckel states that the abaxial side of the tentacular bulbs is concave, whereas the adaxial side is convex, and he gives a drawing in accordance herewith (Haeckel 1881, Plate II, fig. 4). Actually the fact is the contrary (see Plate III, fig. 6). Moreover the cordyli have been drawn too large, especially too thick; they are fairly thin in this specimen. — There is another specimen from the same locality, very badly preserved. As the specimen has hitherto been labelled "*Thaumantias*", and as Haeckel only mentions two specimens from this locality, this specimen has, I think, not been in the hands of Haeckel.

Bigelow's record of *Ptychogena lactea* from the north-western Pacific (1913) is of considerable interest, partly owing to the statement of the occurrence of this species in the Pacific, partly on account of the observation, that the young specimens have a comparatively larger number of cordyli than the full-grown individuals; a specimen with about 50 tentacles had about 160 cordyli.

Among other species, which have been referred to the genus *Ptychogena*, I have already mentioned (p. 13—14) "*Ptychogena erythrogonon*" Bigelow and "*Ptychogena Hertwigi*" Vanhöffen, which both belong to the genus *Chromatonema*.

The medusa, described by Maas (1893) as *Ptychogena longigona* from the north-eastern Atlantic, has not been found since it was described by Maas, though numerous collections have been made in the same region. Setting aside that ocelli are not mentioned in the description, this reminds one to a considerable degree of *Laodicea undulata*, and I am, in fact, very much inclined to think that this is actually the species described by Maas.

Torrey (1909, p. 13) describes a species from San Diego, California: *Ptychogena californica*. Two young specimens were found, 10 mm in diameter by more than half as high, with about 48 tentacles, 1—5 cordyli between every successive pair of tentacles, gonads with 12—14 folds. This is undoubtedly a *Ptychogena*, but I dare not decide, whether it is a distinct species or only young individuals of *Ptychogena lactea*.

Ptychogena antarctica Browne (1907, more thoroughly described in 1910, p. 29) is distinguished from *Ptychogena lactea* by the fact that the gonadial lateral folds are shorter and not attached to the subumbrella, and by the colour, the base of the tentacles being, according to Browne, provided with red entodermal pigment; according to Vanhöffen (1912), who has refound the species in the material from the German South-Polar expedition, the organs are dark coffee-brown. There is one cordylus between every successive pair of tentacles, and in some of these cordyli Browne found nematocysts (see p. 4).

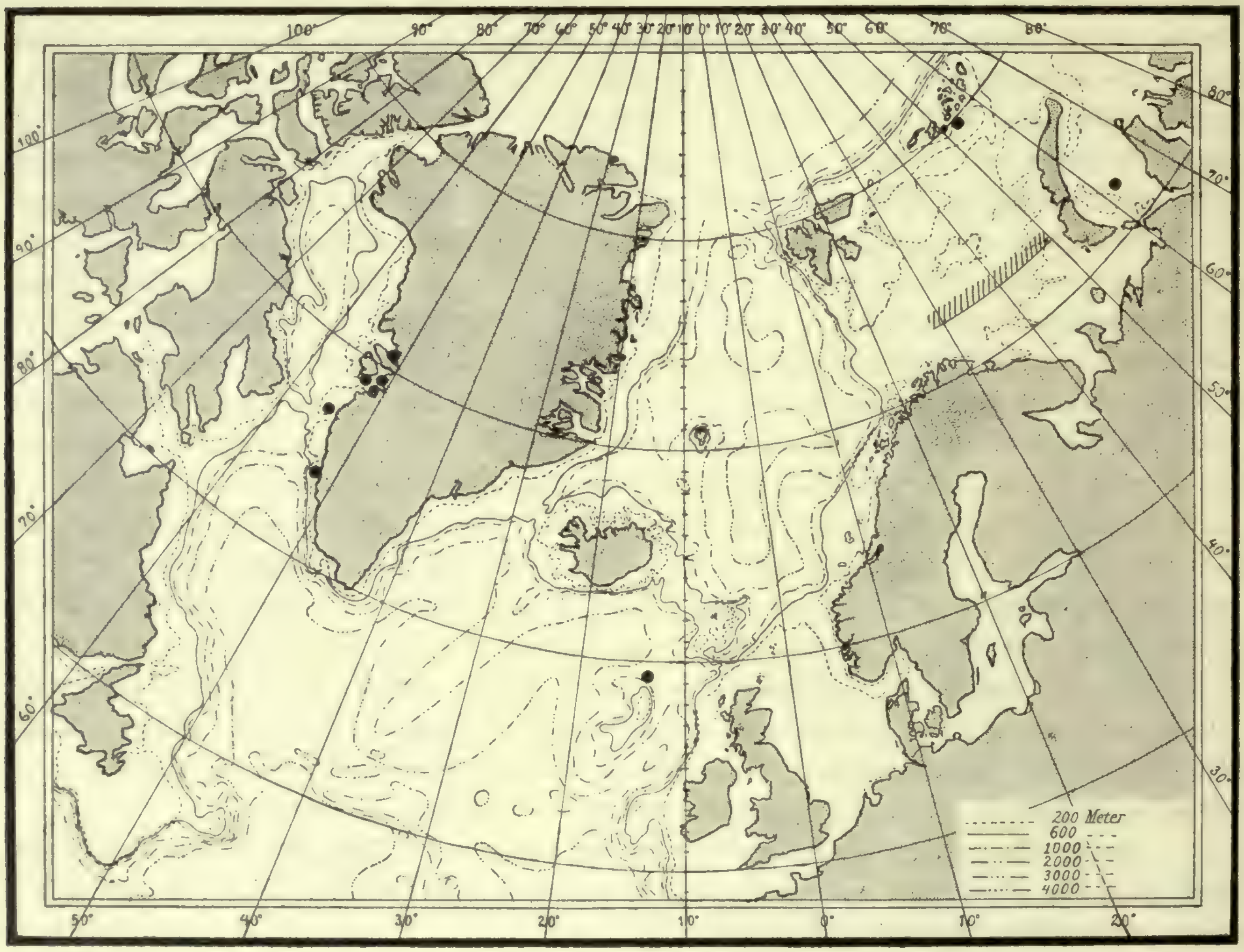


Chart III. Occurrence of *Ptychogena lactea* A. Agassiz in the northern Atlantic and adjacent arctic waters. — The hatching denotes the southern limit of the occurrence in the Barents Sea, according to Linko.

Vanhöffen (1912, p. 366) describes another species, *Ptychogena aurea*, from four small specimens with about 32 tentacles and gold-yellow gonads with mature sexual products. Cordyli are not present. I am not convinced that this medusa belongs to the genus *Ptychogena*, but I will not deny the possibility.

I have had at my disposal for examination 12 specimens of *Ptychogena lactea* from 9 different localities. In the following list I have also included some non-preserved specimens from Godthaab Fjord, Greenland, found by the "Tjalfe" expedition; in the journal of the expedition they are shortly but clearly described, so much so that they may be identified with complete security.

Material (see Chart III).

Greenland:

1) — Lat. 70°41′ N., Long. 52°07′ W., Umanak Fjord. August 6th 1908. Depth 727 m. Ringtrawl, 800 m wire. "Tjalfe" stat. 171. — 1 specimen, about 50 mm wide.

2) — Ritenbenk, Disco Bay. Bergendal. — 1 specimen, about 68 mm wide.

3) — Lat. 69°17′ N., Long. 52°14′ W., south coast of Disco. July 16th 1908. Depth 430—440 m. Ringtrawl, 550 m wire. "Tjalfe" stat. 125. — 2 specimens, 70—90 mm wide.

4) — Jakobshavn, Disco Bay. Bergendal. — 1 specimen, 14 mm wide.

5) — Lat. 66°55′ N., Long. 54°37′ W., 20 miles west of Holstensborg, August 23rd 1908. Depth 66 m. Ringtrawl, 80 m wire. "Tjalfe" stat. 211. — 1 specimen, about 40 mm wide.

6) — Godthaab Fjord, Lat. 64°11′ N. August 30th 1908. Ringtrawl, 120—80 m wire. "Tjalfe" stat. 234. Ringtrawl, 30 m wire. "Tjalfe" stat. 235. — Some few specimens, not preserved.

7) — Greenland, without further details. "Fylla". — 1 specimen, about 40 mm wide.

Atlantic:

8) — Lat. 59°07′ N., Long. 13°32′ W. Moberg. — 3 specimens, two of which are the type specimens of *Ptychogena pinnulata* Haeckel.

Kara Sea:

9) — Kara Sea, without further details. "Dijmphna". — 1 specimen, about 35 mm wide.

Polar Sea:

10) — Cape Stephens, Franz Joseph Archipelago. H. Fisher. — 1 specimen.

The last-mentioned specimen have I seen in the British Museum of Natural History in London, the others are all in the Zoological Museum of Copenhagen.

Moreover the species has been recorded from the following localities: Near Jakobshavn, Greenland (Vanhöffen 1897, p. 273). — Eastern and western part of the Barents Sea north of Lat. 72°30′ N. (Linko 1905, p. 217). — Near Halifax, Lat. 42°08′ N., Long. 69°39′ W. ("Challenger", Haeckel 1881, p. 6). — Nahant, Massachusetts Bay (A. Agassiz 1865, p. 137). — Bering Sea, Sea of Okhotsk, and off the east coast of Hokkaido, Japan (Bigelow 1913, p. 28). — Moreover Levinsen (1892, p. 3) mentions this species from Iceland from the authority of Faber. In his "Naturgeschichte der Fische Islands" (1829) Faber describes 10 species of medusæ, but I am not able to see, how any of his descriptions could refer to *Ptychogena lactea*.

The places of occurrence off the west coast of Greenland are all near the coast in the cold water. No specimen has been found in that part of the Davis Strait, which is occupied by the comparatively warm Atlantic water.

The data now in hand give us the following general picture of the horizontal distribution of this species:

Ptychogena lactea has its home in the arctic regions, and has probably a circumpolar distribution. It is found off the west coast of Greenland between Lat. 64°11′ and 70°41′ N., further in the Barents Sea, the Kara Sea, and near Franz Joseph Archipelago. Only occassionally it has been found in the Atlantic outside the arctic region, viz. north-west of Scotland[1] and in the Massachusetts Bay. In the Pacific it follows the Kamtschatka Current southwards as far as the northern part of Japan.

[1] If the statement of that locality is correct.

A. Agassiz was of opinion that *Ptychogena lactea* was a deep-water species, and he describes, how it is very rapidly killed by the influence of the light and the higher temperature of the surface water. In the Massachusetts Bay, however, the conditions are so unfavourable for this species, that its occurrence in this area gives no reliable information with regard to its habits under normal conditions. Bigelow (1914 a, p. 98) states as follows: "The occasional occurrence of Arctic pelagic organisms in Massachusetts Bay and the Bay of Fundy, such as the medusa *Ptychogena* and the ctenophore *Mertensia*, neither of which has been able to establish itself in the Gulf, shows that there are occasional indraughts of the St. Lawrence water into the latter. But ... its influence is either sporadic, or seasonal, not constant." A. Agassiz (1888, p. 128) repeats the statement, that *Ptychogena lactea* probably is a deep-sea medusa. On the other hand, Vanhöffen (1897, p. 273) mentions a specimen, found frozen up in the ice in the neighbourhood of Jacobshavn in Greenland, and he remarks (p. 274): "Dieses Vorkommen scheint mir nicht dafür zu sprechen, dass diese Art eine Tiefsee-Meduse ist, wie angenommen wurde". Browne (1907, p. 473) likewise remarks: "There is no trustworthy evidence that it is a deep-sea form".

As far as the material, examined by me, is concerned, the depth in which the specimens have been found is only stated in the case of the material, brought home by the "Tjalfe" expedition. The statements of this expedition show that the species may be found in very different depths off the west coast of Greenland. In Umanak Fjord, which is more than 700 m deep, and the deeper water layers of which have a temperature of about 1° C, *Ptychogena lactea* was found in about 500 m depth. In Disco Bay, the lower strata of which consist, likewise, of cold water, the species was found about 350 m below the surface, at a temperature of 0°.9 C. On stat. 211, on the Store Hellefiskebanke, it was found about 50 m below the surface; we have no hydrographical data from the station itself, but judging from observations from neighbouring places, made on the same day, the temperature in the depth in question must have been about 1.5—2° C. Godthaab Fjord is one of the fjords, into which the comparatively warm water-masses of the Davis Strait are not admitted on account of a threshold in the mouth of the fjord. On August 30th 1908, when the temperature of the water in the fjord had been under the influence of the conveyance of a whole summers warmth, the temperature was found to be gradually decreasing from 2°.8 at the surface to 1°.3 near the bottom (77 m). *Ptychogena lactea* was, in this fjord, found both near the surface (30 m wire) at a temperature of about 2°.5, and in 50—70 m depth at about 1°.4 C. As the collections of the "Tjalfe" expedition were made with open nets, we may, of course, not be absolutely certain, but that a few animals may have been captured during the hauling up of the net through higher water layers. With regard to the stations 171 (Umanak Fjord) and 125 (Disco Bay) it should be remarked, however, that hauls where also made in higher water layers, and no specimens of *Ptychogena* were taken in these hauls; it is most probable, therefore, that the specimens from these stations have actually been captured in the fairly great depths here stated.

The most important factor determinating the distribution of *Ptychogena lactea* off the west coast of Greenland seems to be the temperature of the water, the species being only found, where the water is cold.

As far as the other biological habits of the species are concerned, nothing positively can be stated. The specimens from the "Tjalfe" expedition were all found in July and August. With regard to the other material no information of the time of collection are present.

Genus Staurophora Brandt.

Staurophora mertensii Brandt.

Plate I, fig. 9; Plate II, figs. 9—10; Plate III, fig. 7.

Staurophora mertensii Brandt 1838. Schirmquallen. — Mém. Acad. Imp. Sci. St. Pétersb. Sér. 6. Tom. 4. — p. 400. Taf. 24—25.

— *laciniata* L. Agassiz 1849. Contrib. Nat. Hist. of the Acalephæ of North America. — p. 300. Pl. 7.

Oceania multicirrata M. Sars 1851. Beretning ... Reise i Lofoten og Finmarken. — Nyt Magazin f. Naturv. Bd. 6. — p. 158.

Staurophora vitrea M. Sars 1863. Geol. og zool. Iagttag. ... Reise i Trondhjems Stift. — Ibid. 1863. — p. 339.

— *Keithii* Peach 1867.

Staurostoma arctica Haeckel 1879. System der Medusen. — p. 131.

Thaumantias melanops Mc Intosh 1890. Notes from the St. Andrews Mar. Lab. — Ann. Mag. Nat. Hist. Ser. 6. Vol. V. — p. 40. Pl. 8.

Staurophora falklandica Browne 1907. Revision of the ... Laodiceidæ. — Ann. Mag. Nat. Hist. Ser. 7. Vol. XX. — p. 472.

— — Browne 1908. Medusæ, Scottish Nat. Antarct. Exped. — Trans. R. Soc. Edinb. Vol. XLVI. Part II. — p. 235. Pl. I, figs. 1—7.

— *discoidea* Kishinouye 1910. Some Medusæ of Japanese Waters. — Journ. Coll. Sci. Imp. Univ. Tokyo. Vol. 27. — p. 29.

The genus *Staurophora* was established and the species *mertensii* was described by Brandt from drawings and notes of Mertens, who had collected this interesting medusa in the northern Pacific during his circumnavigation. L. Agassiz (1849) gave a new description of the genus, based on several specimens from Boston Harbour, North America. Agassiz rightly referred his specimens to the genus *Staurophora* Brandt, but established a new species, *Staurophora laciniata*. The description given by Agassiz is very thorough and clear. He has not, however, observed the cordyli, and none of his specimens were full-grown; later investigations, therefore, have occasioned certain alterations of the description of the species. The species is now so well known that it is unnecessary to give a general description in this place. Maas (1893) and Hartlaub (1897) have demonstrated that it is unreasonable to separate *Staurophora arctica* from the genus *Staurophora* and place it in a proper genus *Staurostoma*; Haeckel (1879) even placed the two genera within two different families at the same time as he observed that they were nearly related.

With regard to the systematical position there can be no doubt but that the nearest relatives of *Staurophora* are the genera *Laodicea* and *Ptychogena*. Mayer (1910), however, separates the genus widely from these genera and places it within the family *Eucopidæ* on account of the presence of marginal vesicles. These have been described by Linko (1900, p. 4. Taf. II, Fig. 22—25). The marginal vesicles are described as being very small and numerous, one inside each of the tentacles, situated in the ectoderm on the subumbrellular side of the bell inside the circular vessel, just above the supporting lamella of the velum. The structure of the single vesicle could not be examined thoroughly "wegen der schlechten Conservierung" (p. 5). Browne (1908) has tried to find these marginal vesicles, but he found no trace of such organs; it seems reasonable, therefore, to suppose that the vesicles, which Linko found is his, as he states himself, badly preserved material, have simply been due to destruction of the tissues. We must, in any case, wait for new investigations of well-preserved material, before the presence of marginal vesicles in this species can be stated. I myself have sectioned a part of the bell margin of *Staurophora* without finding any vesicles, but, I admit, the material at my disposal is not well suited for such examination.

In the paper quoted above Linko mentions the structure of the ocelli, and he states that within the same specimen we may find every transitional stage from a simple pigment-spot to a cup-shaped eye with a lens.

The most interesting feature in this species is the structure of the mouth. Brandt was of the opinion that the animal had no mouth at all, but that the food was received through the lancet-shaped "arms" in a manner corresponding to the facts in a *Rhizostoma*. Agassiz, on the other hand, calls attention to the eminent extention of the mouth, the corners of the mouth being prolonged along the four arms of the "cross". M. Sars (1863, p. 339) had a similar apprehension. When Haeckel states as a feature characteristic for "*Staurostoma arctica*", that the outer half of the gonadial part is closed, this must undoubtedly be due to a mutual gluening of the folded edges of this part of the mouth; such gluening has been observed by several authors and is also seen in some of the specimens examined by me.

As the corners of the mouth extend as far outwards as the gonads, the latter may in some way be said to have their position on the walls of the "stomach". Hartlaub (1897) takes this as an argument of a near relationship to the *Tiaridæ*. I am more inclined to think that the large extent of the mouth in *Staurophora* is a secondary character, and *Staurophora* is hardly the genus among the *Laodiceidæ* which is nearest related to the *Tiaridæ*. A clear picture of the manner in which the mouth in *Staurophora* has to be understood, has been delivered by Browne (1907, p. 470): "If one were to slit open along the middle the enlarged portions of each radial canal of *Laodicea pulchra*, and imagine the cut margins to be the margins of a mouth, then the position of the mouth, stomach, and gonads would be similar to those of *Staurophora*. I think the mouth of *Staurophora* has arisen by the outgrowth of a central mouth along the enlarged portions of the radial canals of a *Laodice*-like medusa, and consequently those portions of the radial canals have been converted into a four-rayed stomach. The gonads have not changed their position, but in *Staurophora* they have lengthened slightly and meet in the centre of the cross". I quite agree with this apprehension.

The hydroid generation is unknown; but quite young stages of the medusa have been observed by A. Agassiz (1862, p. 2, and 1865, p. 136) and Hartlaub (1897, p. 487), who have been able to follow the development so far that the species might be identified with certainty. — The first developmental stages of the egg have been observed by Wagner (1885, p. 80—81). — Hargitt (1904, p. 43) has demonstrated that the development of the eggs takes place in the genital folds, and that the larvæ leave these folds in the shape of actinulæ.

It is beyond all doubt that the species *Staurophora vitrea* Sars, *Staurophora Keithii* Peach, and *Staurostoma arctica* Haeckel are identical with *Staurophora laciniata* Agassiz. Since Bigelow (1913, p. 27) has seen a number of specimens from the same regions, where Mertens found the medusæ described by Brandt as *Staurophora mertensii*, and has had the opportunity of comparing these specimens from the Pacific with specimens from the Atlantic, it may be stated definitely that the species of Brandt and Agassiz are identical. The *Staurophora discoidea* described by Kishinouye (1910) is only separated from *mertensii* "by the more numerous lateral folds of the genital gland", the number of which was 17 in *mertensii*. The description shows that this Japanese medusa in no respect differs from the Atlantic form of *Staurophora*. Thus all *Staurophora* from the northern seas belong to one and the same species, *Staurophora mertensii* Brandt. — In a paper, published in Danish (1914, p. 420), I have stated that *Staurophora falklandica* Browne also belongs to the same species. This fact will be further demonstrated below.

Vanhöffen mentions this species from the Atlantic outside the Bay of Biscay and from the Indian Ocean (1911, p. 219), further from the southern Atlantic between Trinidad and St. Helena and north-east of St. Paul (1912, p. 366). In the last-named paper he also describes a new species, *Staurophora antarctica* from the antarctic Sea. I feel convinced that none of these medusæ belong to the genus *Staurophora*. The specimens were all quite small, and Vanhöffen found that they agreed with Hartlaub's description of the young *Staurophora* from Heligoland. Common for the latter and Vanhöffen's small medusæ is a general likeness to a young Tiarid. The medusæ from the Indian Ocean (and the Bay of Biscay) are 1—18 mm wide with 4—64 tentacles. The 3 weeks old specimens described by Hartlaub were 10 mm high and a little broader, though far from 18 mm, and they had already more than 100 tentacles and, besides, a number of cordyli; the latter are not found in Vanhöffen's medusæ. In Hartlaub's specimens no traces of gonads were yet visible; Vanhöffen, on the other hand, mentions visible traces of gonads as grooves in the walls of the stomach in some of the specimens from the Indian Ocean (he does not state how many specimens or what sizes) as well as in the specimen from the southern Atlantic, which was only 5 mm high. Vanhöffen rightly calls attention to the fact, that the gonads being developed as grooves in the walls of the stomach is a feature pointing towards the *Tiaridæ*. But in *Staurophora* the gonads are not placed in grooves, but in lateral extensions developed along the line by which the cross is attached to the subumbrella. Finally, Vanhöffen states that the specimens from the Indian Ocean (and the Bay of Biscay) are provided with ocelli on the outer (abaxial) side of the tentacular bulbs. This statement might possibly be due to a slip of the pen or a misprint; but in the figure of the medusa from the southern Atlantic (1912, Taf. XXV, fig. 3) the ocelli are clearly drawn as being abaxial. Altogether, I feel sure that the medusæ, referred by Vanhöffen (in 1911 as well as in 1912) to *Staurophora laciniata*, are really some kind of young *Tiaridæ*. The same is undoubtedly the fact with regard to "*Staurophora antarctica*". This medusa is 10 mm in diameter and has 8 tentacles; the stomach is deep brown with groove-shaped gonads.

In the following I am going to present some scattered morphological observations, made on the material of *Staurophora mertensii* from the North-Atlantic area, examined by me.

The lower, free margin of the folded mouth-edge is sharply turned outwards as in *Laodicea* and *Ptychogena*.

In full-grown specimens the gonadial folds are more highly developed in the middle part of the cross-arms than in the proximal and distal parts, each cross-arm thus being narrowly lancet-shaped. The primary lateral folds have usually 4—6 secondary folds, more seldom 7 or more. In middle-sized specimens the primary folds have, as a rule, the same number of secondary folds as in full-grown specimens, but as the sexual products are not fully developed, and the walls accordingly are thinner, the secondary folds do not come into contact, but are separated by open spaces. During growth of the animal, new primary folds are formed intermediary between the existing ones. The lateral folds are flattened

Table IV. Dimensions of some specimens of *Staurophora mertensii* from Greenland and Iceland.

Locality number	Diameter of specimens, cm	Largest breadth of cross-arms, mm	Length of narrow part of radial canals, mm	Number of tentacles
3	4 1/2	1 1/4	3 1/2	...
2	about 5	1 1/4	4	...
3	5 1/2	2	4	...
—	7	...	5	about 1000
5	8	3	5	more than 1200
—	9	4 1/2	6	about 1100
—	9	2 1/2	5	— 1400
—	10	5	6	— 1400
—	11	7	6	— 1400
—	about 12	8	9—10	— 4400[1]

[1] calculated.

on their upper (umbrellular) side, but they are only fastened to the subumbrella by narrow branched lines (see Plate II, fig. 9, presenting some lateral folds seen from the aboral side after being carefully loosened from the subumbrella).

The largest breadth of the cross-arms and the length of the distal parts of the radial canals, free of gonads (the "proper" radial canals) have been measured on some specimens from Greenland and Iceland. The results are presented in Table IV, in which I have also given the number of tentacles. The numbers of localities will be found in the list of material below. The specimens are arranged according to the size.

In larger specimens the peripheral part of the exumbrella is provided with numerous deep, sharp, radiating furrows of very different length, though rarely more than 10 mm long; the number of furrows is variable, one being found off every second or fourth of the tentacles (see Plate I, fig. 9).

The tentacles (Plate I, fig. 9; Plate II, fig. 10) are hollow. The basal bulbs are conical; the ectoderm of the bulb is somewhat thickened, particularly on the adaxial side (Plate II, fig. 10). Every tentacle bears, on its abaxial side, a narrow, pointed, entodermal spur, penetrating into the gelatinous substance close to the exumbrellular side (Plate II, fig. 10). The distal part of the tentacle is, as a rule, spirally coiled. The tentacles are very numerous and, frequently, so densely crowded that, owing to the lack of room, they seem to be situated in somewhat different height on the bell-margin.

In the young medusa the tentacles are developed in a certain regular succession, as demonstrated by A. Agassiz (1863). In older specimens we find tentacles of every size in quite irregular succession. We may find, however, fully developed tentacles and quite young tentacles almost regularly alternating, particularly in very large specimens. When the tentacles are very densely crowded, these young tentacles may be quite thin and delicate, almost like cirri, and apparently situated a little inside the fully developed tentacles. By closer examination, however, we will always find that the small tentacles are not quite alike, but that some of them are a little larger than the others and approach the fully developed tentacles in shape. When there is a little better room, the young tentacles are placed in the same row as the others and have a fairly broad base, clearly indicating that they are real tentacles, not cirri; besides, a spur is very soon developed. Ocelli, on the other hand, are usually not developed until the tentacle has reached a fairly considerable size. The nearly regular alternation of small tentacles without ocelli and large tentacles with ocelli was the feature, on which Browne (1908, p. 235) based the species *Staurophora falklandica.* As exactly the same feature is frequently found in northern specimens of *Staurophora*, and as *Staurophora falklandica* in all other respects has a complete likeness to the northern *Staurophora mertensii*, there can be no doubt as to the identity of the two forms. Browne himself remarks (p. 236): “It is rather a risky point, I admit, on which to base the character of a new species, as there is the probability of the small tentacles developing into full-sized tentacles with ocelli”.

As a rule, there is one adaxial ocellus on the base of each of the tentacles with the exception of the quite young ones. Some irregularity may, however, be found. In 4 specimens from North-Iceland (“Thor” stat. 220 (04), Loc. No. 5) the ocelli are arranged in the following manner: 1) Diameter of the specimen 8 cm, ocellus on about every 4th of the tentacles; 2) diameter 9 cm, ocellus on about every 3rd—4th of the tentacles, not seldom two ocelli on one tentacle; 3) diameter 10 cm, ocellus on every 3rd—4th of the tentacles; 4) diameter 11 cm, ocellus on almost every 2nd of the tentacles. Sometimes the pigment of the ocelli may disappear on account of the preservation, and we cannot exclude the possibility that this has happened in the specimens mentioned above, as far as the tentacles now destitute of ocelli are concerned.

In this species the number of cordyli (Plate I, fig. 9; Plate III, fig. 7) is always equal to the number of tentacles, the cordyli regularly alternating with the latter, situated in a row a little inside the row of tentacles. The peduncle is thin and lengthened, the distal part is fairly much swollen. With regard to the question of their transformation into tentacles, see above, p. 5.

The velum is very narrow, 1—2 mm broad.

According to the literature this species may attain a size of 20 cm in diameter. Among the material in hand no specimen is more than about 12 cm wide; this is probably due to the collectors having not, for lack of room, preserved the largest of the specimens found. I remember having seen numerous very large individuals, far more than 12 cm wide, in the waters round Iceland in 1908.

Material (see Chart IV).

Greenland:

1) — Egedesminde. Bergendal. — 1 specimen, destructed with osmic acid.

2) — Egedesminde. Traustedt. — 1 specimen, about 5 cm wide.

3) — Lat. 66°06′ N., Long. 54°27′ W., Davis Strait, off Southern Strømfjord. August 28th 1908. Ringtrawl, 150 m wire. "Tjalfe" stat. 223. — 2 specimens, 4.5 and 5.5 cm wide.

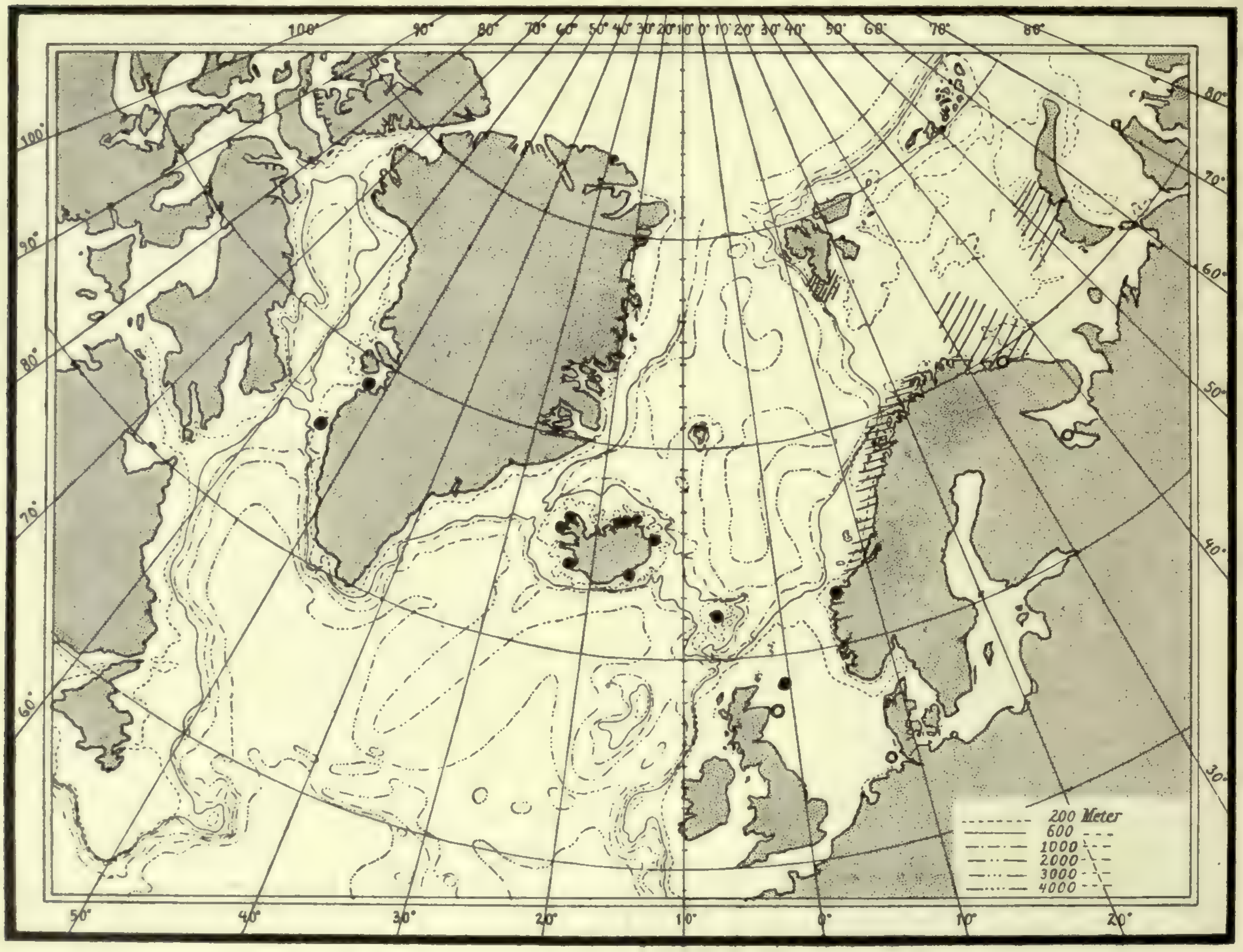


Chart IV. Finds of *Staurophora mertensii* Brandt in the northern Atlantic. ○ and hatching: Occurrence according to the literature.

4) — Lat. 66°01′ N., Long. 54°23′ W., Davis Strait, off Southern Strømfjord. August 28th 1908. Ringtrawl, 150 m wire. "Tjalfe" stat. 225. — A few specimens, not preserved.

Iceland:

5) — Lat. 65°31.5′ N., Long. 13°32′ W., East-Iceland. July 29th 1904. Depth 55 m. 60 m wire. "Thor" stat. 220(04). — 5 specimens, diam. 8, 9, 9, 10, 11 cm.

6) — Near Grjotnæs, Melrakka. July 26th 1896. "Ingolf" Exp. — 1 specimen, about 7 cm wide.

7) — Axarfjord. August 12th 1903. "Beskytteren", Gemzøe. — 1 specimen, torn, probably about 6 cm wide.

8) — Lat. 66°14′ N., Long. 17°28′ W., Skjalfandifjord. July 21st 1904. "Thor" stat. 208 (04). — Pieces of several specimens.

9) — Lat. 66°15′ N., Long. 23°30′ W., off Isafjord. June 15th 1903. "Thor" stat. 134 (03). — One specimen, in the collection of the Plankton Laboratory, Copenhagen.

10) — Dyrefjord. July 14th 1892. Lundbeck. — 1 specimen 7 cm wide.

11) — Lat. 64°06′ N., Long. 23°14′ W., Faxebugt. July 2nd 1908. Depth 98 m. 65 m wire. "Thor" stat. 45 (08). — A piece of the bell-margin with the outer part of a radial canal of a large specimen.

12) — Lat. 63°51′ N., Long. 16°29′ W., Myri Bugt. August 9th 1904. Depth 40 m. "Beskytteren", Gemzøe. — Pieces of a large specimen, which must have been about 12 cm wide. On a 5 cm long piece of the bell margin there are 115 well-developed and as many young and very thin tentacles; the specimen must, accordingly, have had several thousands of tentacles.

Faeroe Islands:

13) — Thorshavn. August 18th 1895. "Ingolf" Exp. — Small pieces of several individuals of different size and stage of development, treated with Flemmings solution.

Norway:

14) — Borgundfjord near Aalesund. June 25th 1902. "Michael Sars", Ad. S. Jensen. — Several torn specimens, not very large.

North Sea:

15) — Lat. 59°46′ N., Long. 0°07′ W., east of the north-point of Scotland. May 7th 1905. 130 m wire. "Thor" stat. 21 (05). — In the collection of the Plankton Laboratory, Copenhagen.

With the exception of the specimens from the localities 4, 9, and 15 the whole of the material here mentioned is in the Zoological Museum of Copenhagen.

Further Distribution:

North Atlantic Area, eastern part:

Spitzbergen (Haeckel 1879, p. 131).

Barents Sea (Linko 1904 a, p. 16 and 1904 b, p. 218). In the eastern (coldest) part of the Barents Sea *Staurophora* is common in the open sea as well as in the neighbourhood of the coast; in the western part it is somewhat scarce in the open sea, and in the summer it is almost never found near the coast. In the unusually *cold* summer of 1899 it was, however, numerous in Kolafjord and in Ekaterin Harbour. Towards the end of the year, on the other hand, it occurs regularly in the neighbourhood of the coast, and it seems then to breed in this region, young medusæ being found here during the first half-part of the year; towards the spring these young medusæ emigrate towards the North.

White Sea (Wagner 1885, p. 80; Birula 1896, p. 16). Wagner found several specimens, 6—12 cm wide, in the Solowetsky Bay in July 1880.

Norway. According to M. Sars (1851, p. 158 and 1863, p. 339) the species is not rare at the coast of Finmarken, where Sars found two specimens, 16 cm wide, in Øxfjord and Havøsund in the summer of 1849. Sars also found a single specimen near Christiansund. Broch (1905, p. 7) records it, though with some doubt, from Puddefjord at Bergen.

East coast of Scotland. Peterhead, May-June (Peach 1868, p. 97); St. Andrews (Mc Intosh 1890, p. 40).

Heligoland. Young specimens about April 1st, full-grown specimens at the end of May 1895 (Hartlaub 1897, p. 484 ff).

North Atlantic area, western part:

West coast of Greenland. All specimens hitherto known from Greenland (Levinsen 1892, p. 145; Kramp 1913, p. 269 aud 1914, p. 420) have been mentioned above.

East coast of North America. New Foundland: Fogo Island, at the surface in July (Bigelow 1909 b, p. 307). — New England: Grand Manan (Stimpson 1854, p. 11; Fewkes 1888 a, p. 233); Eastport (Verrill 1872, p. 6); Massachusetts Bay (L. Agassiz 1849, p. 300 ff.; A. Agassiz 1865, p. 136); Woods Hole (Hargitt 1902, p. 553 and 1904, p. 43—44); Fishers Island Sound (Verrill 1875, p. 43); Frye's Island, New Brunswick (Fewkes 1888 a, p. 233). Bigelow, in a series of papers (1914 a, p. 123—124; 1914 b, p. 12; 1914 c, p. 407; 1915, pp. 267, 273, 274, 319, 320), has dealt with the occurrence of this species off the coasts of New England. It appears from his statements that *Staurophora mertensii* is common north of Cape Cod, whereas sout of this point it occurs only occasionally, and then only in the spring. In the Gulf of Maine it is "a constant inhabitant", though it occurs particularly in the neighbourhood of the shore; Bigelow states that this is not surprising "because it is undoubtedly neritic" (1914 a, p. 124). Young specimens are found at the end of April or at the beginning of May; thus many very young stages were found in Gloucester Harbour on May 3rd 1913 (op. cit. 1914 c); these young stages probably "have passed through the fixed stage in the near neighborhood". On May 17th of the same year several specimens were found, about 2 inches (5 cm) wide. Grown-up individuals are found in June, July, and August. During the investigations in July and August 1913 (op. cit. 1915) *Staurophora* occurred in the whole of the Gulf of Maine, but not south of Cape Cod. Hargitt (1902 and 1904) has found the species in considerable numbers at Woods Hole, but he remarks: "Its occurrence seems to be somewhat erratic, however, as I have taken specimens but twice within recent years" (1904, p. 44).

The American investigations show that *Staurophora mertensii* is indigenous to the Gulf of Maine and breeds here; further that in the said area its occurrence is not limited to the cold water; south of Cape Cod, on the other hand, it is only an occasional visitor, and in the hot season of the year it is quite absent from that area.

Northern Pacific:

Norfolksound; in the Ocean as far as Unalaschka and between Sitka and the Aleutean Islands (Brandt 1835); Dutch Harbor and Prince William Sound, Alaska (Bigelow 1913); Sachalin and northern part of Japan (Kishinouye 1910). In short, it occurs along the southern coast of Alaska, but not off the west coast of North America south of Sitka; further along the coast of Asia as far south as the northern part of Japan.

Falkland Islands:

January 7th 1903 (Browne 1907, p. 473 and 1908, p. 235).

If we compare the statements of the literature with the experiences derived from the material dealt with in the present paper, we will get the following general picture of the distribution and occurrence of *Staurophora mertensii*: In the Atlantic as well as in the Pacific the main distribution of the species is within the arctic region; in both of these oceans, however, the species may penetrate fairly far southwards into boreal regions, though decreasing in frequency. It is exceedingly numerous off the northern and eastern coasts of Iceland, but somewhat scarce off the southern coast, which is washed by the water of the Gulf Stream. In the Barents Sea it mainly keeps itself in the northern and eastern cold parts, whereas it only penetrates to the south-western part, near the Murman coast, in the autumn or in very cold summers. It does not seem to be scarce in the fjords of Finmarken, but only at a few occasions has it been met with at more southerly parts of the Norwegian coast. The occurrence of quite young specimens at Heligoland demonstrates that the species may live and breed in the North Sea, but it is apparently very rare in that area. — Off the Atlantic coast of North America it is indigenous in the Gulf of Maine, but south of Cape Cod it is only met with occasionally and only in the spring months. — In the eastern part of the Pacific its occurrence is limited to the coast of Alaska, in the western part it penetrates as far southwards as extends the influence of the cold Kamtschatka Current.

Everywhere the species is a well-marked coastal-water form. Particularly it is worth mentioning that all finds of young individuals, hitherto known, have been made very near the shore. Young specimens are always found in the spring, April—May, whereas the grown-up specimens are mainly found in August or later (cfr. the statements of the occurrence in the Barents Sea). There can be no doubt, but that *Staurophora* has a neritic, fixed hydroid-generation, which hibernates, and from which the young medusæ are deliberated in the spring.

Of great interest is the bipolar distribution. The medusa described by Browne from the Falkland Islands was found at the beginning of January; thus also in the Antarctic the species is a summer-form.

Family Thaumantiadæ.

Genus Melicertum L. Agassiz.

This genus has an interesting but not very joyous history, in so far as it has given rise to much confusion owing to a peculiar want of criticism by some otherwise prominent authors. Haeckel (1879), as the first, has called attention to this confusion and unravelled the history of the genus. But at the same time Haeckel introduced the generic name *Melicertidium* for a species, which was later found to belong to the same genus, which L. Agassiz called *Melicertum*, and thus the question rose, which of these two names ought to be used as the correct one. Browne (1905) and Mayer (1910) have discussed this question and thereby given new accounts of the history of the genus. As the said authors arrive to opposite results with regard to the question of the correct name, I have thought it worth while to deal with the matter once more from a historical point of view, in order to make out my position to that question.

The *Medusa campanula*, as described by Fabricius (Fauna groenlandica, 1780, p. 366), had

4 radial canals and a small number of tentacles, as it appears from the rather short and vague description. — Péron and Lesueur (1809, p. 352) quoted the description of Fabricius and referred the species to the genus *Melicerta*, established by these authors, and written by Oken (1815) *Melicertum*[1]. Lamarck (1816, p. 508) called the species with the name of *Dianæa campanula*. — Eschscholtz (1829, p. 105—107 has 4 species of Gen. *Melicertum* Oken, all of which have 4 radial canals: *M. campanula* Fabricius, *M. campanulatum* Chamisso, *M. penicillatum*, and *M. pusillum* Swartz. — *Melicertum campanula* is mentioned again by Oken (1835, p. 226) with reference to the description of Fabricius. — Lesson (1843, p. 313) called it *Campanella Fabricii*, and in Mørch's list of the Acalephs of Greenland (Mørch 1857, p. 95) Fabricii medusa is included as *Campanella campanula*.

In 1835 (p. 24) M. Sars described a medusa, *Oceania octocostata*, with 8 radial canals and numerous (40—60) tentacles, found at the coast of Norway. The next year the same species was figured by Ehrenberg (1836, Taf. VIII, figs. 5—7), who does not seem to have known Sars's description. Ehrenberg gives no description of the animal, but his figures are very good and leave no doubt as to the identity of the species. It is peculiar, therefore, that Ehrenberg, in the explanation of the plates, p. 77, refers this 8-rayed medusa to *Melicertum campanulatum* Eschscholtz, which, as mentioned above, has 4 radial canals. — Some specimens from the north coast of Ireland were identified by Wm. Thompson (1843, p. 281) as *Melicertum campanulatum* Ehrenberg. — Sars's medusa was included in the work of Lesson (1843, p. 312) as *Aequorea octocostata*, and in Forbes's Monograph (1848, p. 30, Plate IV, fig. 1) as *Stomobrachium octocostatum*.

A medusa related to *Oceania octocostata* Sars was found in Massachusetts Bay, North America, by L. Agassiz. It is quite unintelligible, that Agassiz should refer this medusa to the genus *Melicertum* Oken and identify it with *Medusa campanula* Fabricius. With Agassiz the genus *Melicertum* gets an entirely new meaning and is even used (as appears from the note on p. 352) as the type of a family *Melicertidæ*, which is characterised by the possession of 8 radial canals. Agassiz referred four species to his genus *Melicertum*: 1) *M. campanula* Fabricius; 2) *M. pusillum* Eschscholtz (which is incorrectly identified with *Oceania octocostata* Sars, *Melicertum campanulatum* Ehrenberg, *Stomobrachium octostatum* Forbes etc.); 3) *M. campanulatum* Eschscholtz (non Ehrenberg); 4) *M. georgicum* A. Agassiz, shortly described in a footnote on p. 349. — A. Agassiz (1865, p. 130—134) gives a thorough and clear description of *Melicertum campanula* sensu L. Agassiz, but A. Agassiz, like his father, regards the species as identical with *Medusa campanula* Fabricius. Browne (1905, p. 765) rightly remarks: "*Melicertum* has really become a new genus, and with a new type species, *M. campanula* A. Agassiz (non Fabricius)".

Since the forthcoming of the work of Agassiz the American species has always been called by the name of *Melicertum campanula*, and when that name is used for medusæ from the Atlantic coast of North America, any doubt of the identity is excluded. But the mistake of Agassiz has been the cause, why the species for a long time to follow was recorded as occurring at the coast of Green-

[1] In the front-list of contents in Oken's Lehrbuch der Zoologie, erste Abth., *Melicertum* is mentioned as the fourth genus of "Walmmanete", and reference is given to p. 125. Also in the alphabetic register in the rear of the book *Melicertum* is found with reference to p. 125. But if we look at p. 125, we will find that "Walmmanete" only includes three genera. Group D of Gen. *Charybdea* is characterised as follows: "Stiel verlängerte Magen, löst sich in viele Hare auf — *Melicerta*". The name *Melicertum* is not found, nor the specific name *campanula*.

land; Lütken (1875, p. 188) who was not aware of the mistake, included *Melicertum campanula* in his list of the medusæ of Greenland, and from the authority of Lütken it was likewise included in the lists published by Winther (1880, p. 274) and Fewkes (1888 b).

Haeckel (1879, p. 136) was the first to see the mistake, and he sharply criticises Agassiz, because he referred the American 8-rayed medusa to *Melicertum campanula* (Fabricius), Eschscholtz, Oken, as also because he referred *Oceania octocostata* Sars to *Melicertum pusillum* Eschscholtz. Haeckel is of opinion, however, that the generic name *Melicertum* Agassiz, *non* Oken and Eschscholtz, ought to be retained for the species *campanula* and *georgicum*, because "Agassiz wirklich die erste gute Beschreibung und Abbildung ... gegeben und die acht Radial-Canäle als Familie-Character hervorgehoben hat".

The European form, on the other hand, is elevated by Haeckel to be the type of a new genus, *Melicertidium*, on account of the presumed presence of "marginale Kolben (oder Cirren)" (op. cit. p. 137). As a matter of fact, Haeckel himself has not seen this medusa, but his meditations are based on the previous descriptions and, obviously, mainly on the figures of Ehrenberg. These figures exhibit a series of short tentacles alternating with the long ones, but on account of the way in which these short tentacles were drawn by Ehrenberg, Haeckel got the apprehension that they were clubs. — After Haeckel (1879) the European form has, mostly, been recorded as *Melicertidium octocostatum*; also Hartlaub (1894, p. 192) uses that name at the same time as he states that the medusa has no marginal bulbs but small tentacles as numerous as the common tentacles, and that this is not a sufficient reason for a generic distinction between the American and the European species.

A review of the generic names, which in the course of time have been applied to these species, will give us the following list: *Oceania*, *Æquorea*, *Stomobrachium*, *Melicertum* and *Melicertidium*. When we want to state, which of those names ought to be used as the correct one, we may at once release the three first, as they are now used for medusæ belonging to quite different groups. Thus remains the choice between the two last-mentioned names.

Browne (1905, pp. 764—767) has discussed this question. After a record of the history of the genus and a demonstration of the identity of *Melicertum* and *Melicertidium* the author states as follows: "After due deliberation, I think it would be the best to retain and amend the genus *Melicertidium*, and to do away with the genus *Melicertum*. To retain the latter genus would only lead to more confusion, as it is clear that *Melicerta* or *Melicertum* of Oken is not the same genus as *Melicertum* of Agassiz. It is really a new genus, with a new type species" (p. 766).

Mayer (1910), on the contrary, prefers the generic name *Melicertum* for the following reason: "... it appears that Ehrenberg, 1837, placed Sars's species in the genus *Melicertum*, and I think it should remain there and be considered a cotype of that genus" (op. cit. p. 207).

Mayer's vindication seems to me to be objectionable, because Ehrenberg's use of the name of *Melicertum* for that medusa was simply due to an erroneous identification. Ehrenberg did not refer his specimens to the species described by Sars (he has, probably, not seen Sars's description), but he identified them erroneously with *Melicertum campanulatum* Eschscholtz.

Something may account for the view of Browne to release the equivocal generic name *Melicertum*, but the use of the name *Melicertidium* seems to me to be precarious, because this genus was founded by Haeckel owing to a false supposition (the presence of clubs), and because the description, therefore, is erroneous. On the other hand, the characterisation of the genus *Melicertum*, given by Agassiz on the basis of the species *campanula*, is clear and correct. Moreover the genus *Melicertum* Agassiz is older than *Melicertidium* Haeckel. Before we decide to release the name *Melicertum* we must, therefore, examine how far the use of that name may give rise to a continued confusion.

First we must examine the fate of the different species of "*Melicerta*" and "*Melicertum*". In order to illustrate the question I have worked out the adjacent synopsis (Table V) including (first column) all species of the genera *Melicerta* Péron & Lesueur and *Melicertum sensu* Oken and Eschscholtz. In the second column I have recorded by whom and when these generic names have been

Table V. Synopsis of the Species of *Melicerta* Péron & Lesueur and *Melicertum* Oken and Eschscholtz.

Generic name *Melicerta* or *Melicertum* used		Name now used
First time	Last time	
Péron & Lesueur 1809:		
Melicerta digitale (O. F. Müll.)	Melicerta digitale Pér. & Les. 1809	Aglantha digitalis
— campanula (Fabr.)	Melicertum campanula Fewkes 1888	? Catablema campanula
— perla (Slabber)	Melicerta perla Blainville 1834	Pelagia perla
— pleurostoma nov.	— pleurotoma Lesson 1843	Turritopsis pleurostoma
— fasciculata nov.	— fasciculata Lesson 1843	Rathkea fasciculata
Eschscholtz 1829:		
Melicertum campanulatum (Chamisso)[1]	Melicertum campanulatum Dujardin 1840	Polyorchis campanulatus
— penicillatum nov.	— penicillatum Lesson 1843	— penicillata
— pusillum (Swartz)[2]	— pusillum Lesson 1843	? swimming actinia-larva
Lesson 1843:		
Melicerta morchella nov.	(not mentioned later)	(undetermined)

[1] Used by Ehrenberg 1836 and Thompson 1843 for *M. octocostatum* Sars.
[2] Used by L. Agassiz 1862 and Kölliker 1864 for *M. octocostatum* Sars.

used for the last time for the species in question. Finally, the last column gives the names, which are now commonly used for these species. *Melicertum pusillum* Eschscholtz and *Melicerta morchella* Lesson have not later been identified.

The application of the name of *Melicertum campanulatum* in Ehrenberg (1836) and of *Melicertum pusillum* in L. Agassiz (1862) is simply due to erroneous identifications, which are, indeed, regrettable enough, but they have done no continuous harm and are of no importance whatever with regard to the question here discussed.

When *campanula* is temporarily excepted, we will see, from the synopsis, that the use of the names *Melicerta* and *Melicertum* in the old meaning (*sensu* Péron & Lesueur, Oken, and Eschscholtz) ceases entirely after the year 1843 (Lesson), in the case of some species even earlier, thus, in any case, long before L. Agassiz used *Melicertum* in a new meaning.

When *Melicertum campanula sensu* Agassiz still as late as in 1888 (Fewkes 1888 b) is recorded as occurring at the coast of Greenland[1], it is due to Lütken who, not being aware of the mistake of Agassiz, included the species in his list of the medusæ of Greenland, whence it proceeded to the lists of Winther and Fewkes. This is rather annoying, it is true, and may, possibly, still involve misunderstandings; but I am not able to comprehend, how this danger might in any way be removed by the introduction of the name *Melicertidium* in the place of *Melicertum*.

Altogether, it seems to me that the use of the generic name *Melicertum* involves no danger any more for a continuation of the confusion. Since 1843 the names *Melicerta* and *Melicertum sensu* Péron & Lesueur, Oken, Eschscholtz have been applied to no other species than *campanula*. "*Medusa campanula*" Fabricius has to be excluded from the system, as it has not been identified with certainty, and all records of "*Melicertum campanula*" from Greenland have to be omitted. When this is remembered, nobody can have any doubt as to the meaning of the names *Melicertum campanula* Agassiz, *Melicertum georgicum* Agassiz, and *Melicertum octocostatum* (Sars).

When, thus, *Melicertum* Agassiz cannot involve misunderstanding this generic name seems to me to be preferable to *Melicertidium*, because *Melicertum* is older and is correctly defined, whereas the definition of *Melicertidium* is incorrect.

The species of the genus *Melicertum*.

Melicertum proboscifer Maas (1897, p. 19) is undoubtedly a Trachymedusa. — Mayer (1910, p. 209) includes *Melicertella panocto* Haeckel among the species of *Melicertum*, though he indicates the possibility that it may belong to the genus *Melicertissa*. In any case, the presence of ocelli on the base of the tentacles excludes the species from the genus *Melicertum*.

Melicertum georgicum A. Agassiz (L. Agassiz 1862, p. 349; A. Agassiz 1865, p. 135) seems to differ but very slightly from *Melicertum campanula* Agassiz; but since the species was described, no medusa belonging to the genus *Melicertum* has been found in the Pacific; it is impossible, therefore, to state, whether it is identical with the Atlantic-American species. *Melicertum georgicum* is found in the Gulf of Georgia on the west coast of U. S. A.

The two Atlantic species, the European *Melicertum octocostatum* Sars and the American *M. campanula* Agassiz, are undoubtedly nearly related. In the first-mentioned species the height of the bell is about 12 mm, the diameter about as much or a little smaller, and there are fairly constantly 64 longer and 64 shorter tentacles. In *Melicertum campanula* the height and the diameter amount to about 25 mm, and in the full-grown individual the tentacles are all alike; Agassiz and (after him) Mayer state their number to be about 70. There does not seem to be any important difference with regard to the shape of the bell, the manubrium, or the gonads. In *campanula*, it is true, the gonads are said to reach entirely to the circular vessel, whereas in *octocostatum* a small distal part of each of the radial canals is free of gonads; but this feature may, as in other medusæ, be subject to much variation. The tentacles of *octocostatum* are going to be further mentioned below; here I shall only remark that there is no decisive difference between the two series of tentacles. *Melicertum campanula* might very well be considered as a variety which attains a more exuberant development, i. e. when the individual is mature it has a comparatively large size, and all of the tentacles are developed to

[1] My record of *Melicertum campanula* as occurring at Frederikshaab in Greenland (1913, p. 268 and 1914, p. 424) is due to a mistake which I very much regret.

the same size, whereas in *octocostatum* the maturity is accomplished, and the growth comes to a standstill, when the individual is only about 12 mm high, and while half the number of the tentacles have not yet reached full size.

The question, whether *campanula* and *octocostatum* are varieties or independent species can only be solved by direct comparison of specimens of both forms. Particularly it must be examined, whether *campanula* possesses the same peculiar subumbrellular lines of nematocysts, which in *octocostatum* issue from the circular vessel running towards the base of the manubrium. Mayer expressly states that such lines are not yet found in *campanula*. Until these lines have been found, the American species must be regarded as specifically different from the European species.

Melicertum octocostatum (M. Sars).

Plate I, fig. 10; Plate III, fig. 8.

Oceania octocostata M. Sars 1835. Beskrivelser og Iagttagelser ... — p. 24. Pl. 4, Fig. 9.
Melicertum campanulatum Ehrenberg 1836. Akalephen des rothen Meeres ... — p. 77. Taf. VIII, Fig. 5—7.
Aequorea octocostata Lesson 1843. Histoire naturelle des Zoophytes. — p. 312.
Stomobrachium octocostatum Forbes 1848. British Naked-eyed Medusæ. — p. 30. Pl. IV, fig. 1.
Melicertum pusillum Agassiz 1862. Contrib. Nat. Hist. U. S. A. Vol. IV. — p. 349.
— — Kölliker 1864. Würtzburger naturwiss. Zeitschr. Bd. 5. — p. 233.
Melicertidium octocostatum Haeckel 1879. System der Medusen. — p. 138.
Melicertum — McIntosh 1890. Ann. Mag. Nat. Hist. Ser. 6. Vol. V. — p. 304.
— *campanula* Linko 1904 b. Zool. Studien im Barents-Meere. — Zool. Anzeiger. Bd. XXVIII. — p. 218.
Melicertidium octocostatum Browne 1905 a. Medusæ ... Firth of Clyde. — Proc. R. Soc. Edinb. Vol. XXV, Part IX. — p. 762.

Melicertum octocostatum is one of the most pretty and elegant among the medusæ of the northern seas. It seems to be fairly common; the number of specimens in the possession of the Zoological Museum is not large, it is true, and the records in the literature are likewise, as a rule, dealing with a comparatively small number of specimens. Only McIntosh states that he has found the species in considerable quantities at St. Andrews. But the journals of the "Thor" frequently mention a "yellow-rayed medusa", which undoubtedly means this species, as being found in considerable numbers, among others at the coasts of Iceland. In the following record of the distribution of the species I have not, however, thought it advisable to pay regard to these records of the journals, but I restrict myself exclusively to mentioning the preserved material in my possession and the statements of the literature.

Description: The umbrella is bell-shaped. The gelatinous substance is fairly much thickened in the apical part of the bell, while the side-walls are thin-walled. The largest diameter is a little above the margin of the bell.

The stomach is, when contracted, longitudinally folded in 8 folds, and there are apparently 8 short, recurved mouth-lips. Sars (1835), however, states that "When these 8 folds are extended, which sometimes happens, the opening of the stomach or the mouth becomes fairly large and circular. Besides the margin is entire ..."[1]. The base of the stomach is broad, octangular, and the whole dorsal side is entirely attached to the subumbrella; there are, accordingly, no "grooves" or "centripetal continuations of the radial canals". The 8 radial canals open in the upper part of the sides of the stomach through perpendicular slit-shaped openings (Plate I, fig. 10). On each side of these openings there is a perpendicular fold. Probably the opening may be closed by means of these two folds, the lumen of the radial canal thus being separated from that of the stomach.

The radial canals are attached to the subumbrella along straight lines, but the lateral walls of the canal are, for the greater part of their length, folded and sinuous and contain the gonads. The folded gonads commence at some distance (about one-fourth of the length of the radial canal) from the stomach; they are most highly developed towards the distal end; distally about 1 mm of the radial canal is free of gonads. It is interesting that even fully developed gonads do not cover the whole of the lateral wall of the radial canal in the dorso-ventral direction; they commence at a fairly considerable distance from the subumbrella, so that on each side of the radial canal nearest to the subumbrella there is a stripe free of gonads; ventrally, on the other hand, there is only a very narrow streak which separates the gonads of the two sides. This structure is demonstrated in Plate III, fig. 8, which represents a transversal section through a radial canal with female gonads.

The subumbrellular lines of nematocysts are clearly visible in several of the specimens examined. There are usually 5—7 of these lines in each octant. They issue from the circular vessel and run in a centripetal direction towards the base of the manubrium; a few of the lines may reach almost to the base of the stomach. It is, probably, those stripes, which were described by Wright (1867, p. 42. Pl. I, fig. 1) as "a supplementary canal system"; Wright states, however, that they issue from the sides of the stomach, running to the circular vessel, forming anastomoses with one another.

The tentacles are hollow; their basal part is laterally compressed. With regard to their number and development I shall make the following remarks: In full-grown specimens there are about 64 large tentacles and about as many small ones; the latter are directed somewhat inwards (adaxially). The large and small tentacles do not, however, alternate in an absolutely regular manner; now and again between two successive fully developed tentacles we may find one quite small tentacle and one of intermediate size, or two fully developed tentacles are placed immediately beside each other, no small tentacle or tentacular bud being found between them. In younger specimens we find tentacles in all stages of development, but as a rule they may be divided into three groups according to size. Specimens 6—7 mm wide have, as a rule, got all of their 128 tentacles, viz. 32 fully developed, a similar number of somewhat smaller, and about 64 quite small tentacles. In an individual, about 7 mm wide, from the north-east coast of Iceland ("Thor" stat. 203 (04)) the mode of development of the tentacles is clearly visible from their size. Beside the 8 perradial tentacles there are, in each octant, 3 long tentacles, which however seem to be a little smaller than the perradial ones; further 4 tentacles, somewhat smaller and still somewhat inwardly directed; and finally 8 quite small tentacles. It is seldom, however, that the grouping in three groups of size is so distinct and regular; as a matter of

[1] "Naar disse 8 Folder udbredes, som undertiden skeer, bliver Mavens Aabning eller Munden temmelig stor og cirkelrund. Iøvrigt er den heelrandet ...".

fact, in such younger specimens we usually find every possible transitional stage of development between the smallest and the fully developed tentacles.

Material (see Chart V):

North-East Iceland:

1) — Lat. 66°10′ N., Long. 14°29′ W., near Langenæs. August 13th 1904. Surface. "Thor" stat. 253 (04). — Specimens in the collection of the Plankton Laboratory, Copenhagen.

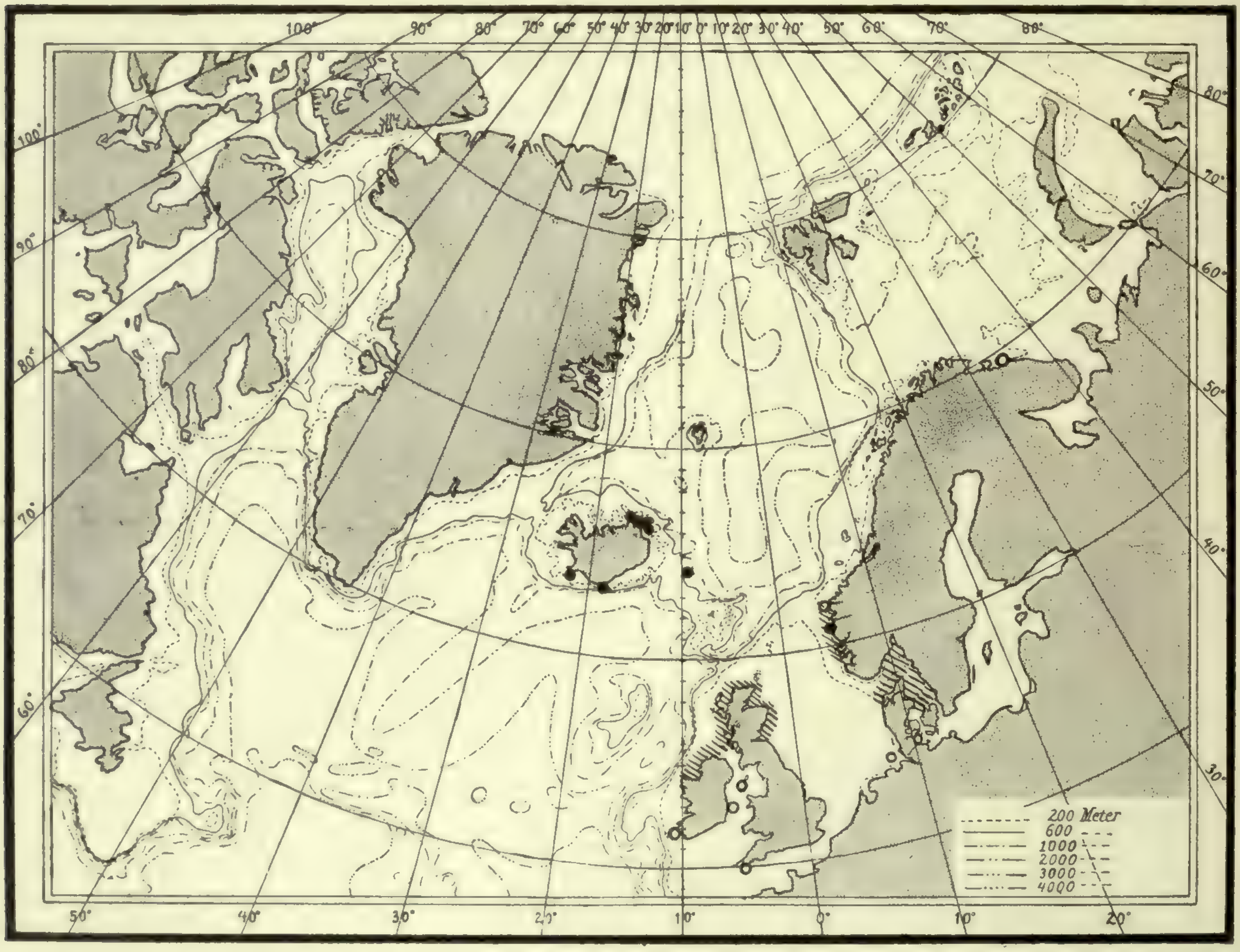


Chart V. Occurrence of *Melicertum octocostatum* M. Sars. ○ Occurrence according to the literature. In the hatched regions the species is commonly occurring.

2) — Lat. 66°17′ N., Long. 14°27′ W., near Langenæs. July 20th 1904. Depth 77 m. Young-fish trawl, 80 m wire. "Thor" stat. 203 (04). — 1 specimen, height 6 mm, diameter 7 mm.

3) — Lat. 66°25′ N., Long. 14°51′ W., near Langenæs. August 14th 1904. 70 m wire. "Thor" stat. 257 (04). — Specimens in the collection of the Plankton Laboratory, Copenhagen.

4) — Lat. 66°46.5′ N., Long. 14°57′ W. August 20th 1904. Depth 102 m. "Beskytteren", Gemzøe. — 1 specimen, height 11 mm, the apical jelly 3 mm.

5) — North of Tistil Fjord. August 30th 1904. Depth 28 m. "Beskytteren", Gemzøe. — 1 specimen, fairly large.

6) — Lat. 66°38′ N., Long. 16°18′ W., off Melrakka. August 15th 1904. Depth 102 m. "Thor" stat. 258 (04). — 5 specimens, diam. 6—11 mm.

South Iceland:

7) — 9 miles off Krisuvikrberg. July 11th 1903. "Thor" stat. 162 (03). — Specimens in the collection of the Plankton Laboratory, Copenhagen.

8) — Portland Head. July 18th 1903. "Thor" stat. 176 (03). — Specimens in the collection of the Plankton Laboratory, Copenhagen.

Between East Iceland and the Faeroe Islands:

9) — Lat. 64°05′ N., Long. 9°38′ W. August 6th 1904. 80 m wire. — Specimens in the collection of the Plankton Laboratory, Copenhagen.

Norway:

10) — Børfjorden, near Bergen. August 8th 1903. "Michael Sars". — 1 specimen, 5 mm wide.

11) — Bergen. July 6th 1911. Th. Mortensen. — 2 specimens, height 5—8 mm, diameter 6—7 mm.

The specimens from the localities 2, 4, 5, 6, 10, and 11 are in the Zoological Museum of Copenhagen.

Further Distribution:

According to Browne (1900, p. 696) *Melicertum octocostatum* is common at the coasts of Scotland but rare in the southern part of the British area. As to the east coast of Scotland it has been found in Cromarty Firth (Romanes 1876 a, p. 526), at St. Andrews (McIntosh 1890, p. 304; Crawford 1891, p. 296), and in Firth of Forth (Wright 1867, p. 42). At the west coast of Scotland it seems to be common in Firth of Clyde and in the fjords and sounds of the surrounding area (Forbes 1848, Kölliker 1864, Browne 1900 and 1905 a).

It is still common in the gulfs on the north coast of Ireland (Thompson 1843 and 1856, Forbes 1848), but only occasionally it drifts further southwards. A few specimens are found at Dublin (Greene 1857), Port Erin (Browne 1895) and Valencia Harbour (Browne 1900 and 1905 a, Delap 1905).

In the British Channel it has only been taken once, *viz.* at Falmouth (Cocks 1849), "abundant in the summer".

The northernmost locality, where the species has been found, is the Murman coast; here it has been taken at three occasions (Linko 1904 b). — At the Norwegian coast it was taken in great numbers at the Florø by M. Sars (1835). It is also recorded from the surroundings of Bergen (Broch 1905) and from Drøbak in Kristiania Fjord (Ehrenberg 1836).

In the Danish waters it has been found at several localities in the Skagerrak and the Kattegat, and Möbius (1873) records it from the harbour of Kiel.

The literature as well as the data derived from the present material demonstrate that *Melicertum octocostatum* is a distinctly neritic species (the American *Melicertum campanula* is likewise "strictly confined to the coast water" (Bigelow 1914 a, p. 125)). The only locality in some considerable distance from the coast is that which is mentioned in the above list as No. 9.

The depth in which the individuals have been captured is only stated in very few cases. Some of the specimens from Iceland are fished with 70—80 m wire out; on "Thor" stat. 259 (04) three hauls were made with the young-fish trawl; the journal records as follows: 20 m wire: "yellow-rayed medusa"; 35 m wire: about 20 do.; 70 m wire: about 20 do. The depth of the bottom was 102 m, and *Melicertum* has been evenly numerous at least in the upper fifty meters. Undoubtedly it does not penetrate down into any great depth; it may be met with, on the other hand, close to the surface.

The horizontal distribution, it will be seen, is rather narrowly limited. The species has never been found in high-arctic regions, and it does not, on the other hand, penetrate very far southwards. It is indigenous at the northern coasts of the British Isles, but only occasionally it is carried towards the Channel. It is very noticeable that most of the Icelandic localities are crowded around Cape Langenæs, the north-eastern point of Iceland. This seems to be more than a casuality and it may possibly be explained by the fact, that the Polar Current strikes the coast of Iceland at this point and puts a stop to the effects of the Irminger Current (that branch of the Gulf Stream which runs northwards along the west coast and eastwards along the north coast of Iceland). It is hardly possible that the numerous individuals of *Melicertum*, found around Langenæs in July and August 1904, may have been carried to the Icelandic coast by the Polar Current; most probably they have been hatched at the west or north coast of Iceland and carried eastwards by the Irminger Current as far as Langenæs, where they have come to a stop, because the cold water of the Polar Current barred the passage. At the Norwegian coast the species is numerous off the part between Stavanger and Stat. It has frequently been found in the Danish waters, but never in any large number, so that this area is possibly beyond the proper area of distribution of the species. The fact is, probably, that the polyp generation does not live at the Danish coasts and the southern parts of the British coasts, but that the medusa is usually carried to these regions in the summer. In order to elucidate this question more thoroughly we shall have to look at the seasons, in which the species has been found on the various localities.

All the Icelandic collections have been made during the summer months; we have no information from the other seasons of the year. The finds from the north-east point are from the time between July 20th and August 30th.

The specimens from West-Norway, mentioned by Broch, as well as the specimens from Bergen, recorded in the present paper, have all been taken in July and August. More interesting is the statement of Sars, that the species occurs at the Florø from the early spring to September.

We possess several and detailed records of the occurrence at the British Isles, but it is not very easy to get a reliable apprehension of the occurrence in that area. Most statements agree that the species appears in the Scottish fjords in the month of May and is numerous during the summer months. Browne (1905) states that it occurred in the Firth of Clyde from May 20th to October 11th 1902, grown-up specimens in May, grown-up as well as young specimens in July; besides many grown-up individuals were found at Arran in August 1897. According to McIntosh (1890), on the other hand, it appeared at St. Andrews in August; it was numerous in October but not yet mature; large specimens were found in December; he also found it at St. Andrews in January, and Crawford (1891) likewise found a mature specimen in January at the same locality. All records being kept together, it seems to me the most probable that the breeding of the medusa takes place at the end of the autumn or in the winter, that the unknown polyp-generation lives during the later winter months and deliberates the medusæ in the first spring-months; the medusæ then appear in the fjords in May or later and grow to maturity in the course of the summer and autumn.

The finds at Port Erin and Valencia Harbour were made on May 26th and 27th and on June 2nd and July 19th (altogether 4 finds, according to Browne 1900 and Delap 1905). There are two possible explanations of these finds: The few specimens, mentioned by the said authors, may have been carried southwards after their deliberation from the polyps; but as the dates of the finds are mostly antecedent of the season, at which the species is most numerous in the northernmore regions, there is also the possibility that they have been deliberated in the neighbourhood of the finding-places from hydroids originating from medusæ, which were carried down there in the preceding winter or autumn, that the hydroid, accordingly, is able to live here in the winter, as also the medusæ may pass the spring but die away towards the hot summer time. Both explanations give the result, that the whole cyclus of development cannot be traversed on the spot, but new specimens must be imported every year. From the data now in hand it is impossible to state with certainty, which of the two possibilities is the correct one. It seems to me, however, that the first explanation is the more probable, as it appears that the species is able to live in the Danish waters in the warmest months of the year.

As far as the Danish waters are concerned, the facts lie more clearly. All finds from the Kattegat have been made between medio June and medio August. According to Möbius it occurs at Kiel in October—November. In the eastern part of the Skagerrak it has been found in November (International Plankton Catalogues). Nothing indicates that the polyp generation should live in the Danish waters. The medusæ found here have undoubtedly been imported by the current. They are able to keep themselves alive in our seas during the hot summer months, but it is very improbable that they ever breed here. More detailed records of the occurrence of *Melicertum octocostatum* in the Danish waters will appear in a future paper.

Melicertum campanula L. Agassiz.

As mentioned above this species is possibly identical with *Melicertum octocostatum* Sars. It occurs at the eastern coasts of North America, being common from Eastport to Cape Cod. It has been mentioned from that area by the following authors: L. Agassiz (1862, p. 349), A. Agassiz (1865, p. 130—134), Verrill (1871, p. 6), Fewkes (1888 a, p. 233), Mayer (1910, p. 207), Bigelow (1914 a, p. 125; 1914 b, p. 11; 1915, p. 316, 319, 320). South of Cape Cod it has only been taken once, *viz.* at Woods Hole (Nutting 1901, p. 382).

According to these authors the species appears at the coasts of New England in May and disappears in July or August. Young individuals are found in the spring.

Bigelow characterises it as boreal-neritic; it has never been found more than 10 miles from the shore.

Genus Dipleurosoma Boeck.

Dipleurosoma typicum Boeck.

Mayer 1910, Medusæ of the World. p. 224.

Bell usually flatter than a hemisphere and about 15 mm in diameter. Stomach flat, with an irregular outline; there are four lips. The number of radial canals arising from the periphery of the stomach ranges from 5 to 18; they branch in an irregular manner, all branches communicating with the circular vessel. The gonads are developed upon a number of the radial canals adjacent to the stomach. More than 100 marginal tentacles, each carrying an ocellus on the inner side of the bulbous base. Velum is well developed.

North-Atlantic coasts of Europe and off Newfoundland.

Family Mitrocomidæ Torrey.

Leptomedusæ with open marginal vesicles.

The first author who has paid attention to the systematical importance of the open marginal vesicles is E. Metschnikoff (1886 a, p. 5: 1886 b, pp. 81 ff.). He separated *Halopsis ocellata* Agassiz from the *Æquoridæ* (among which it had been placed by A. Agassiz and Haeckel) and the genera *Tiaropsis* and *Mitrocoma* from the *Eucopidæ*, and united the said forms into a family *Lafoëidæ*. Metschnikoff had demonstrated that the planulæ of "*Laodice cruciata*" as well as of *Mitrocoma annæ* developed into hydroids, exactly resembling *Cuspidella* Hincks. At the first sight this seems rather peculiar; but Metschnikoff calls attention to the fact that *Laodice* is an Ocellate, *Mitrocoma* a Vesiculate, while *Tiaropsis* forms the connecting link between the two. If we regard *Tiaropsis* as a more primitive form of the *Lafoëidæ*, the *Thaumantidæ* (to which belongs *Laodice*) and the medusæ with open marginal vesicles have to be regarded as two diverging branches of the same group.

Maas (1893, p. 60) amends the family *Lafoëidæ* sensu Metschnikoff, including *Tiaropsis*, *Mitrocoma*, *Phialis* (i. e. *Halopsis cruciata* Agassiz), *Halopsis ocellata*, and perhaps *Euchilota* and *Mitrocomella*.

Torrey (1909, p. 16) proposes the name of *Mitrocomidæ* for this family, because the medusæ in question bear no relation to the hydroid-family *Lafoëidæ*. The name *Mitrocomidæ* is also used by Browne (1910, p. 32), who gives a revision of the genera of the group and announces a critical revision of the species. Browne hesitates to refer *Halopsis* to this family, until its marginal vesicles have been thoroughly examined. Later Bigelow (1914 a, p. 102) has demonstrated that *Halopsis ocellata* has open sensory pits of the type of the *Mitrocomidæ*. Bigelow (1913) also unites the leptomedusæ with open marginal vesicles into a family *Mitrocomidæ*, whereas Mayer (1910) does not apply more systematical importance to the open marginal vesicles than that of a generic character. In the quoted paper (1913) Bigelow demonstrates that "*Laodice cellularia*" A. Agassiz has open marginal vesicles and accordingly belongs to the *Mitrocomidæ*. As this species has many marginal vesicles but is destitute of cirri, it makes a proper genus, *Halistaura* nov. — As generic characters Browne uses the presence or absence of cirri or ocelli together with the number of marginal vesicles. Thus the genus *Mitrocomella* is only separated from *Mitrocoma* by the number of vesicles being constantly 16, whereas in the full-grown *Mitrocoma* the number exceeds 16. This does not seem to me to be sufficient reason for a distinction of genera. The species *polydiademata* (the only species of *Mitrocomella* hitherto known) does not differ from the species of the genus *Mitrocoma* in any important characters, and I prefer, therefore, to refer it to that genus, following Mayer (1910, p. 290).

A synopsis of the genera of the family *Mitrocomidæ* will now look as represented in Table VI:

Table VI. Synopsis of the Genera of *Mitrocomidæ* Torrey.

Genera	Number of radial canals	Cirri	Ocelli	Number of marginal vesicles
Cosmetirella Browne	4	÷	÷	8
Cosmetira (Forbes) Hartlaub	4	+	+	8
Tiaropsis Romanes	4	÷	+	8
Mitrocoma Haeckel	4	+	÷	16 or more
Halistaura Bigelow	4	÷	÷	about 12—24
Halopsis Agassiz	12—16 or more	+	÷	numerous

\+ = present; ÷ = absent.

Strictly spoken, the "cirri" of *Cosmetira* should not be called with that name, as they are comparatively short and rigid and may not be coiled up spirally; they ought, as stated by Hartlaub (1905), be designated as dwarf-tentacles.

Genus **Mitrocoma** Haeckel.

Mitrocoma polydiademata (Romanes).

Tiaropsis polydiademata Romanes 1876 a, Prelim. Observations on the Locomotor System of Medusæ. — Philos. Trans. Roy. Soc. London. Vol. 166. — p. 274.

Tiarops — Romanes 1876 b, Some New Species, Varieties and Monstrous Forms of Medusæ. — Journ. Linn. Soc. London. Vol. XII. — p. 525.

Tiaropsis — Romanes 1877, do. (plates). — ibid. Vol. XIII. — p. 194; Pl. XV, fig. 3.

Mitrocomella polydiadema Haeckel 1879, System der Medusen. — p. 185.

— — Browne 1895, Medusæ, L. M. B. C. District. — Proc. Trans. Liverpool Biol. Soc. Vol. IX. — p. 279.

— *fulva* Browne 1903, Medusæ from Norway and Spitzbergen. — Bergens Museums Aarbog 1903. — p. 17. Pl. I, fig. 3; Pl. III, figs. 1, 3.

— *polydiademata* Browne 1905 a, Medusæ, Firth of Clyde. — Proc. R. Soc. Edinb. — p. 767.

— *polydiadema* Browne 1910, National Antarctic Exped., Nat. Hist. Vol. V. — p. 33.

Mitrocoma polydiademata Mayer 1910, Medusæ of the World. — p. 290.

Mitrocomella — Bedot 1912, Histoire des Hydroïdes, 4me période. — p. 414.

Umbrella nearly hemispherical, 12—22 mm wide. Stomach small with a cross-shaped base and 4 short, folded lips. Gonads linear or somewhat sinuous, extending along the outer three-fourth of the 4 radial canals. About 48 long tentacles with conical basal bulbs; numerous long marginal cirri; 16 open marginal vesicles; no ocelli. Manubrium, gonads, and tentacular bulbs red or yellowish-brown. — Hydroid unknown.

Haeckel introduced the spelling *polydiadema*, but Romanes called it *polydiademata* in all of the four papers in which he mentioned the species.

Romanes mentions this species for the first time in his preparatory work on the locomotor system of the medusæ (1876 a) and describes it in the other paper of the same year (1876 b). Romanes describes the 16 "diadems", each containing 30 "pearly nodules"; he further mentions the high illuminating power of the animal. The description is, however, rather short and not very exhaustive.

In 1903 Browne described a species, *Mitrocomella fulva* from Bergen and Plymouth, but in 1905 he states that it is identical with *polydiademata*, of which species he gives, at the same time, a new and more thorough description based on specimens from the Firth of Clyde (1905, p. 767).

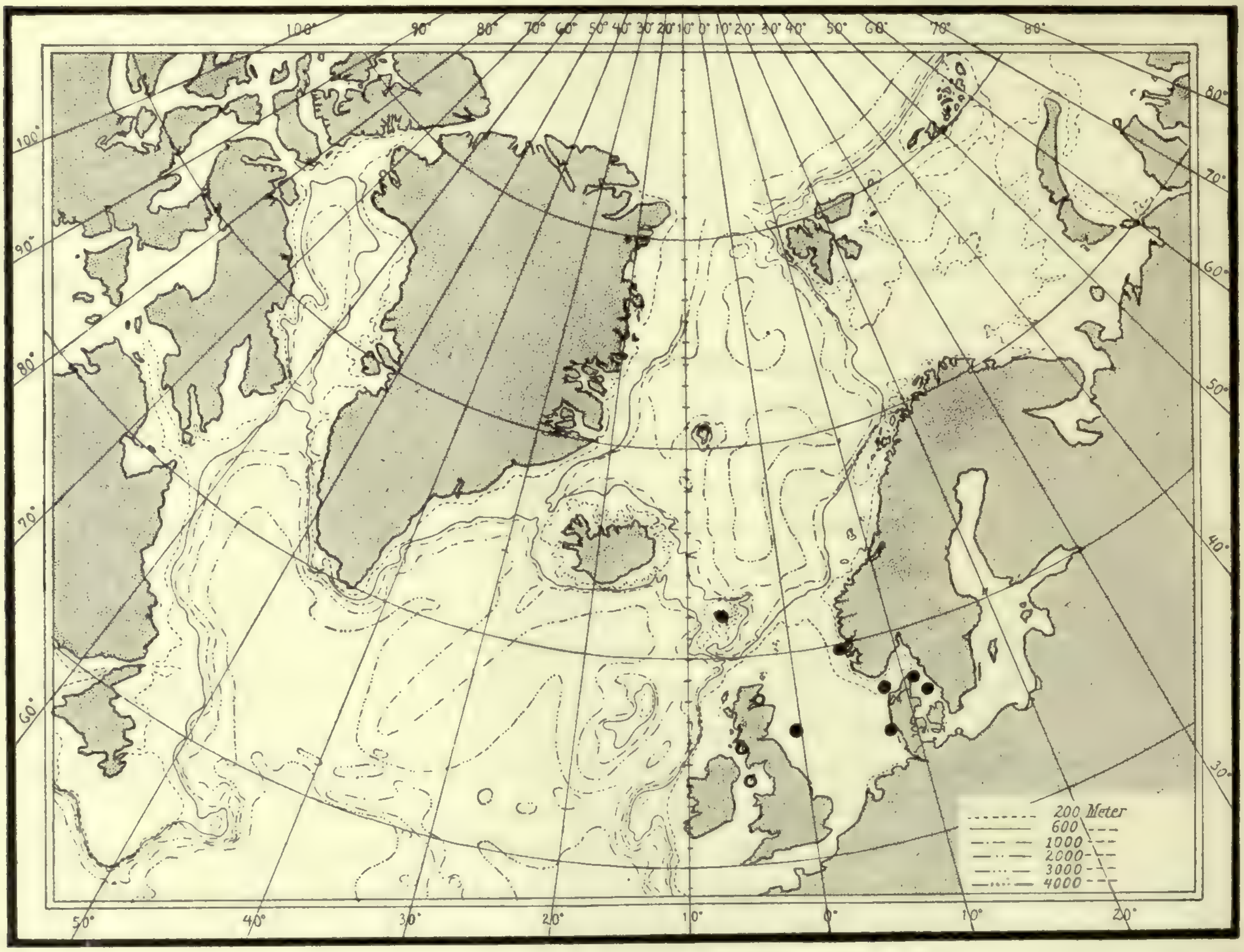


Chart VI. Finds of *Mitrocoma polydiademata* (Romanes). o Occurrence according to the literature.

Material (see Chart VI):

1) — Off Trangisvaag, Faeroe Islands. May 14th 1904. Young-fish trawl at the surface. "Thor" stat. 80 (04). — 1 specimen, about 13 mm wide. In the collection of the Plankton Laboratory, Copenhagen.

2) — Lat. 59°54′ N., Long. 4°34′ E., near the coast of Norway south of Bergen. May 8th 1905. Young-fish trawl, 65 m wire. "Thor" stat. 24 (05). — 1 specimen, about 22 mm wide.

3) — Lat. 56°08′ N., Long. 0°15′ W., about 90 miles off the mouth of Firth of Forth. May 4th 1905. Young-fish trawl, 80 m wire. "Thor" stat. 16 (05). — 4 specimens, 10—14 mm wide. In the collection of the Plankton Laboratory, Copenhagen.

The specimen from the Faeroe Islands (Loc. 1) is a female, the gonads of which are very much sinuous but not mature. From Loc. 3 there are one female and three males. The specimen from Loc. 2 is a male, the gonads of which are three-fourth the length of the radial canals; the number of tentacles in this specimen cannot be stated exactly, but it exceeds 40. In the males the gonadial part of the radial canal is laterally compressed like a broad band and somewhat sinuous. Beside the specimens here mentioned the Zoological Museum possesses a number of fairly small specimens from Danish waters.

The species is previously known only from rather few localities, viz. Bergen (Browne 1903), Cromarty Firth (Romanes), Firth of Clyde (Browne 1905 a), Port Erin (Browne 1895 and 1905 a), and perhaps Plymouth (Browne, 1905, is not quite sure that the specimen of "*Mitrocomella fulva*" from Plymouth belongs to the present species). The known area of distribution is now extended to comprise the Faeroe Islands and the Danish waters from the Slugen (near Esbjerg) to Anholt Knob in the Kattegat.

At Port Erin and in the Firth of Clyde it was found in June and July; moreover Browne found many large specimens at Port Erin in May and quite young stages at the end of April 1894. The comparatively large specimens examined by me from the Faeroe Islands, the coast at Bergen, and the North Sea have all been found in May. The specimens from the Danish waters, which are all fairly small, have been taken on the following dates: Slugen September 29th, Horns Rev September 11th and November 9th, Skagerrak June 1st and Juli 29th, Anholt Knob November 2nd.

The data now at hand do not constitute a sufficient base on which to give a reliable picture of the life history of the medusa. As large specimens have been found in the spring, the medusa must be able to pass the winter and thus to breed in the spring; but it seems also that the breeding may take place in the summer time, as the specimen described by Browne from Firth of Clyde, taken on June 27th, contained large eggs, many of which were "ready for liberation"; the specimen in question was only 10 mm in diameter, so that the size, at which the medusa becomes mature, is subject to much variation.

Genus **Cosmetira** (Forbes) Hartlaub.

Forbes (1848, p. 42) divided the genus *Thaumantias* into two subgenera, *Cosmetira* with two kinds of tentacles, *Thaumantias* with only one kind of tentacles. The genus *Cosmetira* was again defined by Hartlaub (1909, pp. 82—89). It is characterised as *Mitrocomidæ* with 4 radial canals, 8 marginal vesicles, and with dwarf-tentacles between the proper tentacles. The genus comprises the following species: *Cosmetira pilosella* Forbes, *C. megalota* (Maas), and the antarctic *C. frigida* Browne; the latter was described by Browne (1910. p. 35) from some badly preserved specimens, and only provisionally referred to this genus.

Cosmetira pilosella Forbes.

Thaumantias (*Cosmetira*) *pilosella* Forbes 1848, British Naked-eyed Medusæ. — p. 42. Pl. VIII, fig. 1.

i. p. *Laodice cruciata* Haeckel 1879, System der Medusen. — p. 132.

Euchilota pilosella Browne 1896, British Hydroids and Medusæ. — Proc. Zool. Soc. London, 1896. — p. 484. Pl. XVI, figs. 7, 7 a.

Cosmetira pilosella Hartlaub 1909. Ueber *Thaumantias pilosella* Forbes und die neue Lafoëiden-Gattung *Cosmetira*. — Zool. Anz. Bd. 34. — p. 82.

Umbrella much rounded, about 20 mm wide. Stomach small, with a cross-shaped base and 4 folded lips. Gonads narrow, linear, somewhat sinuous, placed along the 4 radial canals, leaving both ends free. About 64 short tentacles with globular basal bulbs; between each successive pair of tentacles there are about 6 short, solid dwarf-tentacles; a number of similar organs are distributed over the outer part of the exumbrella. There are 8 large, open, adradial marginal vesicles. Velum is broad. Stomach and gonads are reddish-purple, tentacle-bulbs dark purple.

Forbes's description and particularly his coloured drawings of this species are excellent. Among others the following remark is appropriate: "... towards the margin ... it is as if woolly ...". Forbes, it is true, did not observe the marginal vesicles; these have first been described by Gosse (1853), who also mentions the high illuminating power of the animal. Haeckel included Forbes's medusa among his numerous synonyms of "*Laodice cruciata*", and this has caused a good deal of confusion. Thus the "*Laodice cruciata*" of Garstang (1893—1895, pp. 215 and 233 ff.) and Browne (1895, p. 276) is actually *Cosmetira pilosella*, as later demonstrated by Browne. On the other hand, the medusa which in Crawford (1891) and Mc Intosh (1890) is called "*Laodice cruciata* (*Thaumantias pilosella* Forbes)" is a real *Laodicea* (see above, p. 28). In 1896 Browne (1896, p. 484. Pl. XVI, figs. 7 and 7 a) identified some medusæ, examined by him, as Forbes' species, which he referred provisionally to the genus *Euchilota*, and thereafter we find it in the literature under the name of *Euchilota pilosella* until 1909, when Hartlaub (1909, pp. 82—89) gave a new definition of the genus *Cosmetira* and a new and thorough description of the type-species *pilosella*, based on some specimens from Bergen previously identified by Broch (1905, p. 7) as *Irene viridula*. The name *Cosmetira pilosella* has been adopted by Mayer (1910, p. 261) and Browne (1910, p. 32). In Bedot's Histoire des Hydroïdes, on the other hand, it is unfortunately mentioned as a synonym of "*Laodice cruciata*"[1].

I have no objections or additions to Hartlaub's thorough description. Hartlaub calls attention to the fact that the "cirri" are fairly short and rigid threads and are never spirally coiled; they are, accordingly, no typical cirri and ought to be called dwarf-tentacles.

Material (see Chart VII):

Lat. 59°48′ N., Long. 1°23′ W., close south of the Shetland Islands. July 22nd 1905. Depth 85 m. "Thor" stat. 122 (05). — 3 specimens.

In the journal of the "Thor" from this station only one species of Leptomedusæ is recorded, and a roughly made sketch makes it probable that it means the present species. It was taken in the young-fish trawl with 25 m wire in great quantities, with 65 m wire commonly, and with 125 m wire in smaller numbers. It is possible that the specimens from the deepest haul have been captured during the hauling up through the upper water-layers, where the species, according to the journal, was present in great numbers.

The area of distribution of this species is fairly narrowly limited. It has been found near Bergen (Broch 1905, Hartlaub 1909), at the Shetland Islands (Forbes 1848), at the Isle of Man (Browne 1895), Valencia Harbour (Browne 1895 and 1900, Delap 1905), Falmouth (Alder in For-

[1] Compare the note on p. 21.

bes 1848), Plymouth (Garstang 1893—95, Lebour 1917); it is mentioned in the International Plankton Bulletins from the Bristol Channel and the British Channel every year in May and August.

The present author has seen this species in great quantities during his stay at Plymouth in 1914. It was found for the first time on the night between May 19th and 20th, 7 miles south of Eddystone lighthouse; the individuals were of different sizes, none were fully grown; it was found again on nearly the same spot on the night between May 25th and 26th and further until June 11th con-

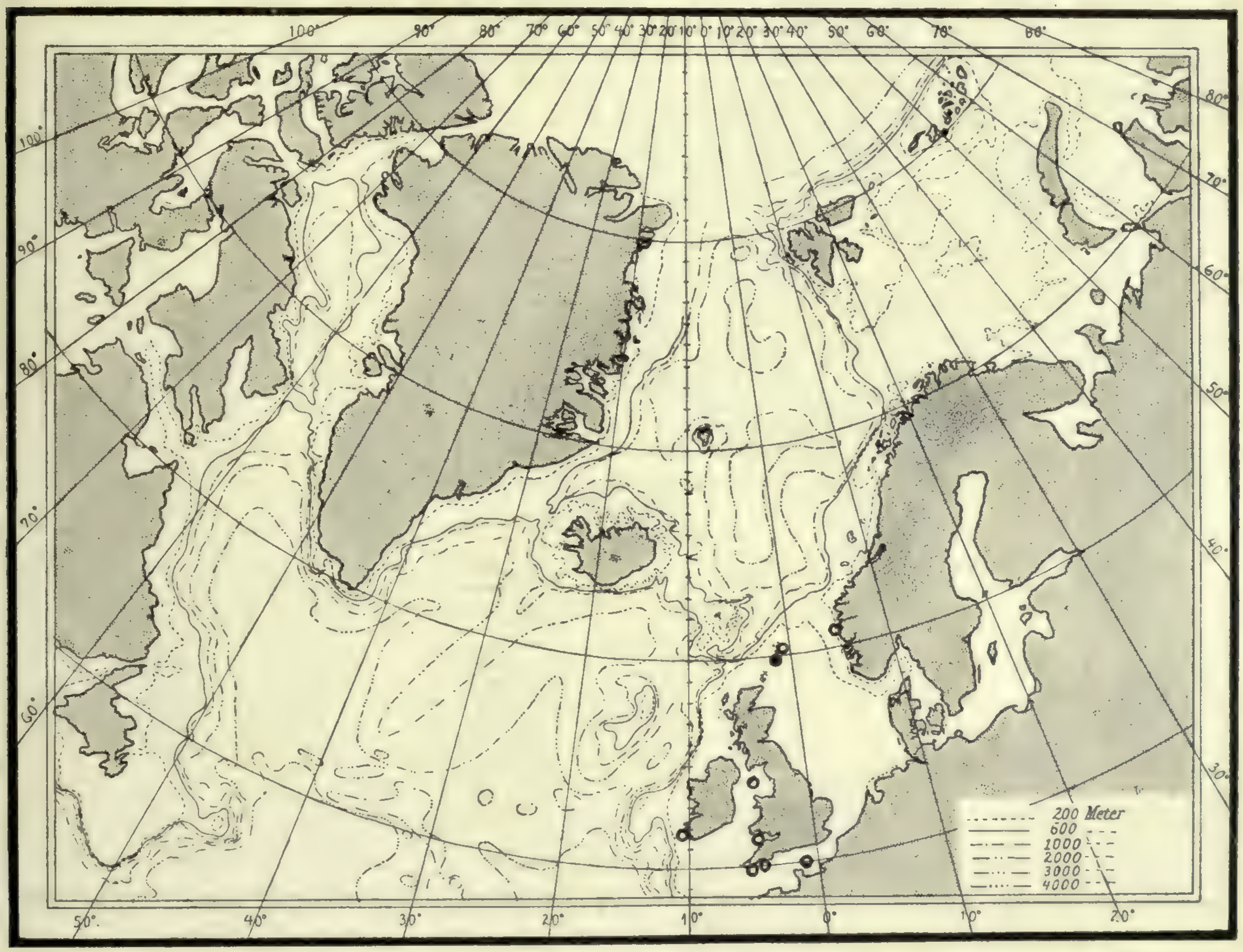


Chart VII. Occurrence of *Cosmetira pilosella* Forbes. ○ Occurrence according to the literature.

stantly in large numbers, but still no full-grown specimens. Plankton samples taken nearer the shore in the neighbourhood of Plymouth during the same space of time contained no specimens of this medusa.

According to Garstang (1893—95, pp. 233 ff.) and Lebour (1917, p. 161) it appears at Plymouth in May or June, is one of the most predominant medusæ in July and August, and disappears in September. At Valencia Harbour it has been found from the end of April until October (Browne 1896, p. 484 and 1900, p. 719; Delap 1905, p. 11). Browne has found quite young specimens at Valencia Harbour both in May and in August. Moreover a tiny medusa (with 2 tentacles), found at Plymouth in September 1895, is considered to belong to this species. As mentioned above, I found no full-grown individuals at Plymouth as late as June 11th; the Misses Delap, on the other hand, found large specimens at Valencia Harbour on May 28th 1900; some of these specimens spawned in the aquaria, and the eggs developed into planulæ and further to small hydroids.

The statement of the last-mentioned authors shows that in certain localities the species may breed as early as about June 1st, but all other records as well as my own observations indicate that

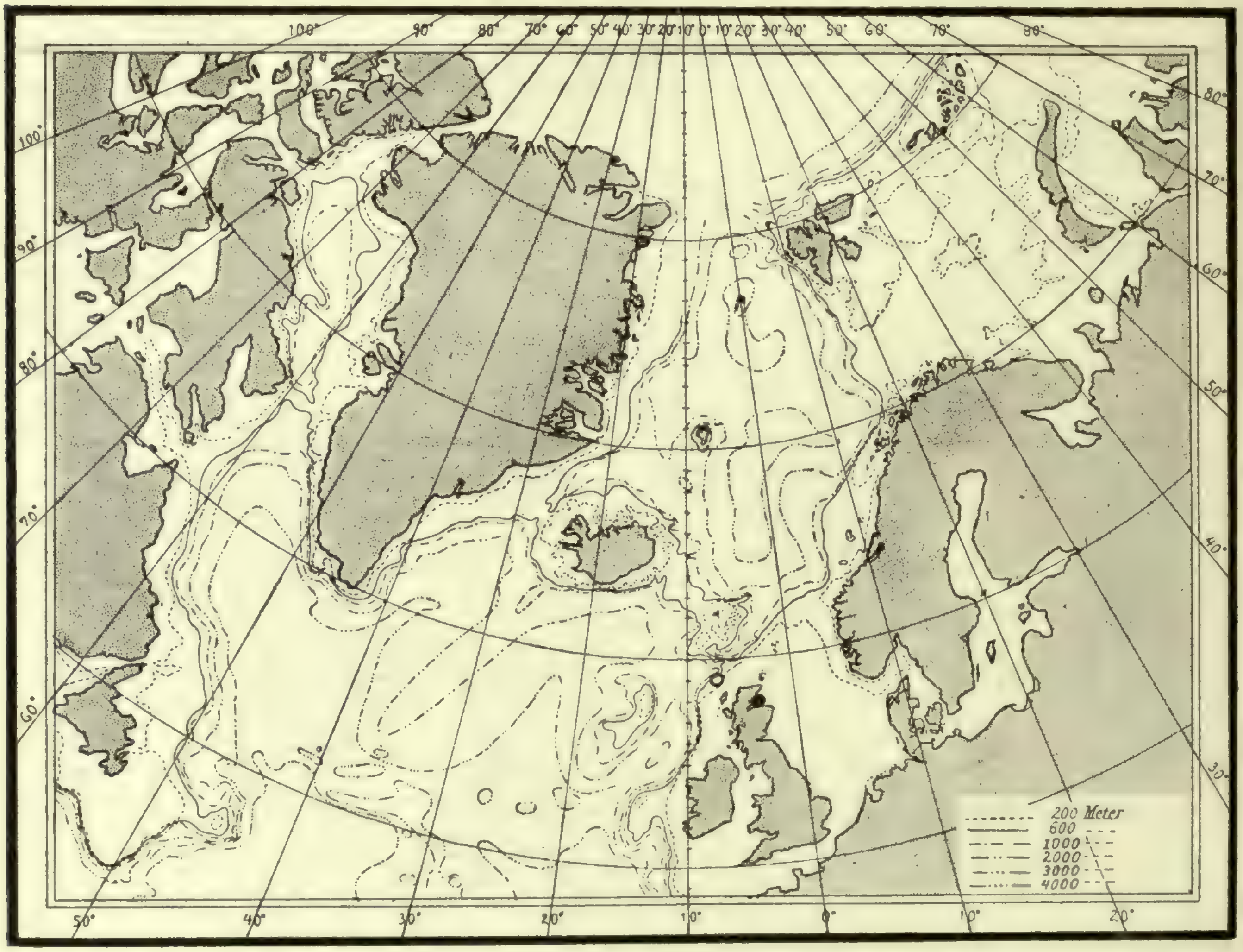


Chart VIII. Occurrence of *Cosmetira megalotis* (Maas). ○ Occurrence according to the literature.

the medusæ reach maturity in the late summer months, and that the hydroid generation, which has never been found in nature, passes the winter and deliberates the young medusæ in the early spring.

Cosmetira megalotis (Maas).

Halopsis megalotis Maas 1893, Ergebn. d. Plankton-Exped. Bd. II. K. c. — p. 57. Taf. VI, Fig. 3, 4, 5, 6.
Mitrocoma megalota Mayer 1910, Medusæ of the World. — p. 289.
Cosmetira megalotis Browne 1910, National Antarctic Exped., Nat. Hist. Vol. V. — p. 33.

This medusa was taken by the Plankton-Expedition north-west of Scotland on July 19th 1889; it has not been found again since it was described by Maas.

The species is very like *Cosmetira pilosella*; it is, however considerably larger (about 30—40 mm wide) and has a greater number of tentacles (about 100 against 64) and about 800 dwarf-tentacles; the tentacle-bulbs are less broad. The stomach is larger, and the gonads are shorter, extending along the outer one-third or half part of the 4 radial canals. The marginal vesicles seem to be somewhat more flattened.

The Zoological Museum of Copenhagen possesses 2 specimens from the following locality (see Chart VIII):

Murray Firth. September 4th—5th 1904. "Thor". — 2 specimens.

The specimens are 25—30 mm wide. They have about 100 tentacles and about 8 times as many dwarf-tentacles, most of which are placed on the bell-margin itself, some being, however, displaced a little upwards upon the exumbrella. There are 8 large, flat marginal vesicles. The gonads occupy the distal half-part of the radial canals but do not quite reach the circular vessel. The larger specimen is a male, the smaller one is a female.

The specimens agree very well with Maas's description. Maas, however, does not mention the fact that the dwarf-tentacles may partly be situated on the exumbrella at a little distance above the bell-margin. Moreover it is not appropriate to state, that the shape of the umbrella is flat; this medusa has the same bent-down margin as *Cosmetira pilosella*. The specimens are preserved in alcohol; the dark pigmentation has disappeared, and the tentacle-bulbs as well as the manubrium and the gonads have now a dirty-yellow colour.

The possession of 8 large, open marginal vesicles and the short and rigid (not spirally coiled) dwarf-tentacles put it beyond doubt that this medusa belongs to the genus *Cosmetira*.

Genus Halopsis A. Agassiz.

Halopsis ocellata A. Agassiz.

Plate IV, figs. 1, 2, 3, 4, 5. Textfigs. 6, 7, 8, 9 a—r.

Halopsis ocellata A. Agassiz 1863, Mode of Development of the marginal tentacles of ... Medusæ. — Proc. Boston Soc. Nat. Hist. Vol. IX. — p. 219.
— — A. Agassiz 1865, North American Acalephæ. — p. 99. Figs. 143—150.
— — Haeckel 1879, System der Medusen. — p. 217.
— — Fewkes 1888 a. On certain Medusæ from New England. — Bull. Mus. Comp. Zool. Harvard Coll. Vol. XIII, No. 7. — p. 233. Pl. III, fig. 3.
— — Hargitt 1904. Medusæ from the Woods Hole Region. — Bull. U. S. Bureau of Fisheries. Vol. 24. — p. 51.
— — Mayer 1910. Medusæ of the World. — p. 323.
— — Bigelow 1914 a. Explorations in the Gulf of Maine July and August, 1912. — Bull. Mus. Comp. Zool. Harvard Coll. Vol. 58, No. 2. — p. 102.

Description: Umbrella is watchglass-shaped, the gelatinous substance comparatively thick, particularly so in the central part of the disk, evenly diminishing in thickness towards the margin.

The diameter of the largest specimen at my disposal is about 56 mm. The manubrium consists of a flattened stomach (Plate IV, fig. 1), circular or star-shaped in outline, and a short mouth-tube. The diameter of the stomach is about one-fifth the diameter of the disk. The length of the mouth-tube of a well-grown specimen is about 4 mm, its diameter at the narrowest part about one-half the diameter of the stomach. The lower (distal) part of the mouth-tube is somewhat expanded, divided into 4 folded lips separated by 4 slight incurvations, not by deep incisions. The stomach is fastened to the subumbrella along the edges of the proximal parts of the radial canals, thus a number of triangular pouches existing between the subumbrella and the dorsal wall of the stomach. The number of radial canals varies (in the present material) from 12 to 17; the canals are arranged in four clusters (Plate IV, fig. 1). From the central point four canals issue, each of which is very soon divided into 3—5 branches; as a rule the branching is completed within the outline of the stomach, so that apparently the radial canals arise separately from the periphery of the latter. The fully developed canals reach the circular vessel,

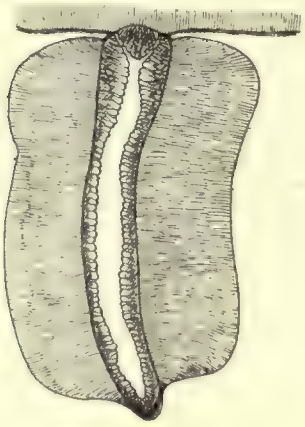


Fig. 6.

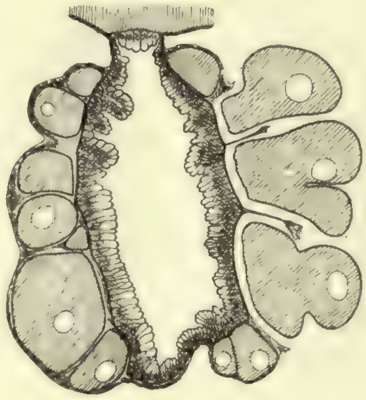


Fig. 7.

Fig. 8.

Fig. 6. *Halopsis ocellata* A. Agassiz. Transversal section through a radial canal with male gonads. × 85. — Fig. 7. *Halopsis ocellata* A. Agassiz. Transversal section through a radial canal with female gonads. Three of the eggs are ready for liberation. × 120. — Fig. 8. *Halopsis ocellata* A. Agassiz. Transverse section through the distal part of a radial canal, free of gonads. *Obs.* the high development of the entoderm and the narrow lumen. × 240.

but sometimes we may find young canals terminating blindly somewhere on the subumbrella (textfigs. 9 *c*, *f*, *h*, *k*). The points of connection between the radial canals and the circular vessel are, as a rule, not equidistant. The stomach sends out a short conical prolongation along each of the radial canals (Plate IV, figs. 1 and 5). The lines of attachment of the radial canals to the subumbrella are very narrow (Plate IV, figs. 1 and 5; textfigs. 6, 7, 8). The gonads (Plate IV, figs. 1, 3, 4; textfigs. 6 and 7) are situated along the radial canals, forming a narrow, somewhat folded band on each side of the canal, leaving both ends free. The gonads commence at a distance of 2—7 mm from the periphery of the stomach and terminate 1—2 mm from the circular vessel. The dorso-ventral extension of the gonadial bands comprises nearly the whole of the lateral walls of the canals, commencing very close to the subumbrella and ventrally leaving but a very narrow line to separate the gonads of the two sides (textfigs. 6 and 7). In the short distal part of the radial canals, free of gonads, the entoderm is highly developed, so that in this part the lumen of the canal is quite narrow (textfig. 8).

There is a large number of hollow tentacles (Plate IV, fig. 2), fairly long and very contractile;

the tentacular bulbs are broadly conical; the number of tentacles amounts to at least about 450. Between every successive pair of tentacles there is one long, fine, solid cirrus (more seldom two cirri), which may coil itself spirally. The marginal vesicles are large open folds of the velum, containing a large number of lithocysts. The number of marginal vesicles between two successive radial canals is very variable according to the distance between the points of termination of the canals; the average number is 5—6. The velum is 2.5—3 mm broad. — The specimens, preserved in formaline or alcohol, are colourless.

The genus *Halopsis* was established by A. Agassiz (1863 and 1865) as a genus belonging to the family *Æquoridæ* and containing the species *H. ocellata* with about 16 radial canals, and *H. cruciata* with 4 radial canals. In Haeckel's System der Medusen (1879) *Halopsis ocellata* remained among the *Æquoridæ*, whereas *Halopsis cruciata* became the representative of a new genus *Phialis* of the *Eucopidæ*. — As mentioned above (p. 58), Metschnikoff (1886 a, 1886 b) established a new family for Leptomedusæ with open marginal vesicles, the family which we now call *Mitrocomidæ*, and he referred *Halopsis cruciata* as well as *ocellata* to this family. He was followed in this respect by Maas and Torrey, whereas Browne (1910) thought it more correct to await a closer investigation of the marginal vesicles of *Halopsis ocellata*, before it should be definitively included in the family *Mitrocomidæ*. Such an investigation was carried out by Bigelow (1914 a), and the systematical position of the species is thus stated. In Mayer, Medusæ of the World (1910) *Halopsis ocellata* is still placed among the *Æquoridæ*.

A. Agassiz (1865) has given a thorough description of this species. True, the marginal vesicles are called "large compound eyes", but the drawings (figs. 146 and 147) leave no doubt but that they are identical with the large open marginal vesicles. The North-European specimens, examined by me, agree in every regard with Agassiz's description of the American *Halopsis ocellata*. Agassiz states, it is true, that the mature individuals are 2—2½ inches in diameter (= 50—65 mm), whereas the European specimens reach maturity when about 35 mm wide and, according to the material hitherto known, do not exceed 56 mm in diameter. It must be remembered, however, that I have only measured preserved specimens, and the size becomes usually somewhat reduced by the preservation. But even though the European specimens do not, as a rule, reach quite the size of the American specimens, the agreement with regard to the shape is so complete that there can be absolutely no doubt, but that they belong to the same species. — Agassiz has examined young specimens and found that they have only 4 radial canals.

The species, described by Agassiz, was seen again, for the first time, by Fewkes (1888 a, p. 233), who found individuals up to 6 inches in diameter. His specimens differ from the type by the fact that "the radial canals arise regularly, not in four groups, from the stomach cavity". This may depend, I think, on the fact mentioned above, that the branching of the radial canals takes place and is completed inside the periphery of the stomach, so that the canals are completely separated when leaving the latter. The same "independent origin of the radial canals" has been observed by Bigelow (1914 a, p. 102), who found four fragmentary specimens of the species.

The mode of origin of the radial canals was the chief character by which Agassiz would separate the genera *Halopsis* and *Stomobrachium*. It is very probable that the two genera cannot be kept apart. But nothing definitely can be stated about the matter, as the two species of *Stomobrachium* (*lenticulare* Brandt and *tentaculatum* A. Agassiz) are very deficiently described and have never been found again since the original descriptions were published (Brandt 1835, p. 358. Taf. III, Fig. 6, 7. — A. Agassiz 1865, p. 98, figs. 140—142). Neither cirri nor marginal vesicles have been observed in any of the species of *Stomobrachium*.

Halopsis ocellata has never been recorded from the European waters, though it is actually not uncommon in the Atlantic between the British Isles and Iceland[1].

A few of the specimens at my disposal are in the collection of the Plankton Laboratory in Copenhagen. The medusæ of that collection are mostly identified by Professor Damas, who has labelled the specimens of *Halopsis ocellata* as *Stomobrachium norvegicum*. I have never seen this name mentioned in the literature, and Dr. Browne, on inquiry, has informed me that neither he knows that name. Damas has possibly been of opinion that the specimens represented a new species; but a description was never published. Owing to the war I have not been able to communicate with Professor Damas concerning the matter; a letter, sent to him, has never been answered and has, probably, not reached him. As mentioned above, I consider it to be beyond any doubt that this North-European medusa is identical with the North-American *Halopsis ocellata* A. Agassiz.

Material (see Chart IX):

Iceland:

1) — Lat. 63°43.5′ N., Long. 22°22′ W., south of Reykjanæs. July 8th 1904. Depth 109 m. "Thor" stat. 174 (04). — 2 specimens.

2) — Lat. 63°18′ N., Long. 21°30′ W., south of Eyrarbakki. July 8th 1904. — Depth 178 m. Young-fish trawl, 70 m wire. "Thor" stat. 176 (04). — 1 specimen.

3) — Lat. 62°43′ N., Long. 20°42′ W., south of the Vestman Islands. July 9th 1904. Young-fish trawl, 50 m wire. "Thor" stat. 179 (04). — 2 specimens.

4) — The Gulf at Heimaey, Vestman Islands. August 7th 1905. "Beskytteren", Fr. Johansen. — 1 specimen.

5) — South of the Myrdalsjøkel. August 17th 1903. "Michael Sars". — 3 specimens.

6) — Under Iceland. August 16th 1903. "Michael Sars". — 5 specimens.

7) — Lat. 64°04′ N., Long. 13°48.2′ W., Myri Bay. July 24th 1904. Depth 68 m. "Beskytteren", Gemzøe. — 3 specimens.

8) — Lat. 64°35′ N., Long. 11°45′ W., off the south-eastern coast of Iceland. August 8th 1904. Depth 348 m. Young-fish trawl, 20 or 70 m wire. "Thor" stat. 241 (04). — 3 specimens.

9) — Lat. 63°12′ N., Long. 11°45′ W., between Iceland and the Faeroe Islands. August 7th 1904. Young-fish trawl, 20 m wire. "Thor". — 4 specimens.

10) — Lat. 61°34′ N., Long. 18°43′ W., south of Iceland. July 10th 1904. Young-fish trawl, 15 m wire. "Thor" stat. 181 (04). — 2 specimens, in the collection of the Plankton Laboratory, Copenhagen.

[1] Günther (Report on the Coelenterata ... of the North Atlantic. — Ann. Mag. Nat. Hist., ser. 7, vol. XI, 1903, p. 426) mentions two small medusæ which "bear a considerable resemblance to the young of *Halopsis ocellata* as described by Agassiz", but from his description it does not seem probable that the specimens have belonged to that species.

West of Scotland:

11) — East of Rockall. July 28th 1913. 150 m wire. "Armauer Hansen" stat. 17 (1913). — 1 specimen, in Bergens Museum.

12) — Lat. 57°03′ N., Long. 11°20′ W. May 28th 1908. Young-fish trawl, 65 m wire. "Thor" stat. 12 (08). — 1 specimen.

13) — Lat. 56°56′ N., Long. 9°01′ W. May 28th 1908. Depth 140 m. Young-fish trawl, 65 m wire. "Thor" stat. 11 (08). — 1 specimen.

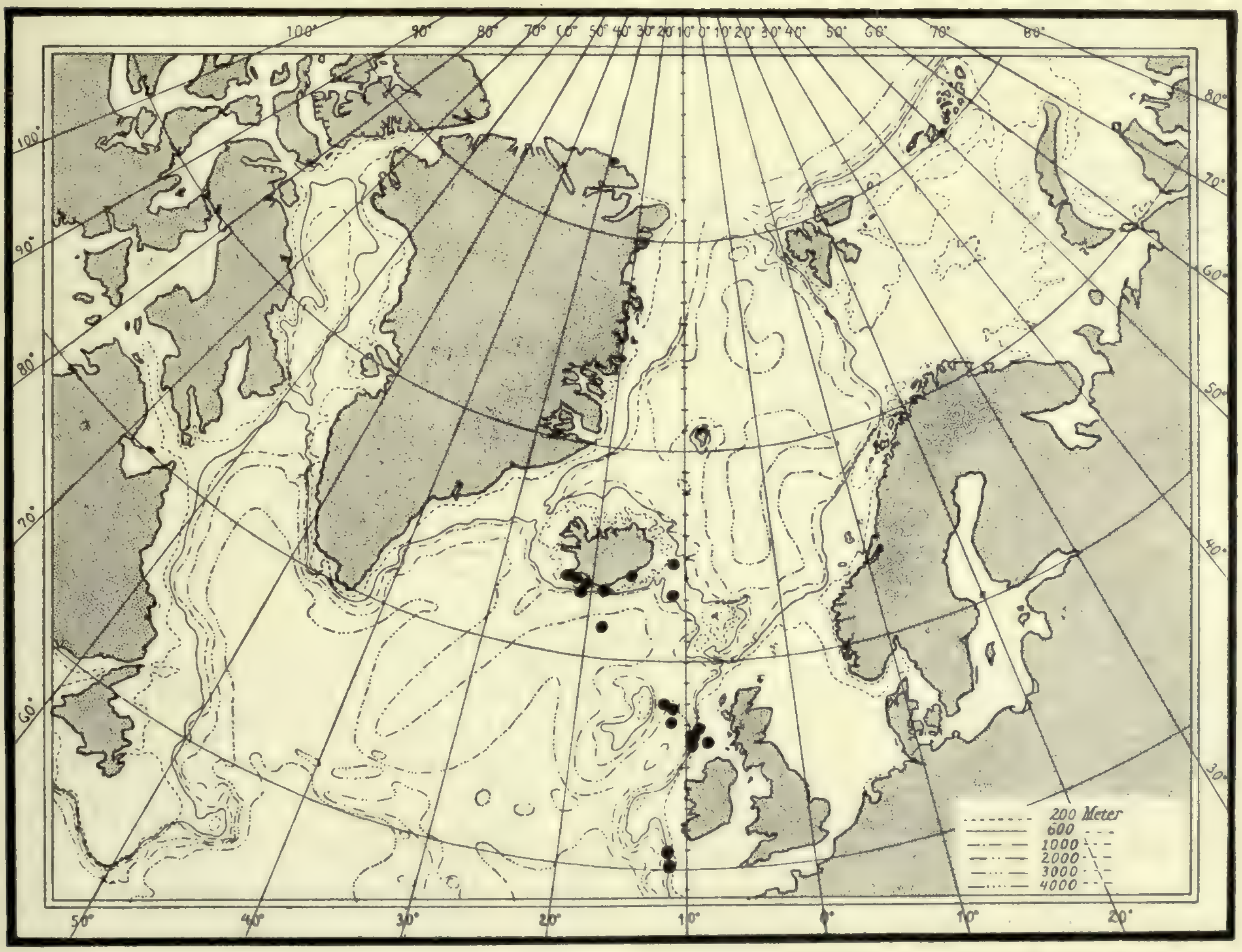


Chart IX. Occurrence of *Halopsis ocellata* A. Ag. in the north-eastern Atlantic.

14) — Lat. 56°00′ N., Long. 9°32′ W. June 10th 1905. Depth 1040 m. Young-fish trawl, 300 m wire. "Thor" stat. 74 (05). — 1 specimen.

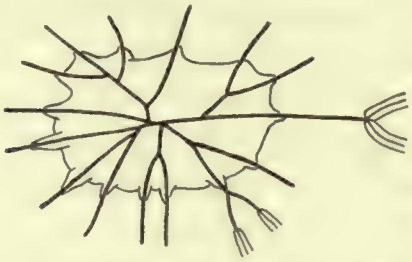
South-west of Ireland:

15) — Lat. 51°00′ N., Long. 11°43′ W. June 15th 1905. Depth 840—1400 m. Young-fish trawl, 200 m wire. "Thor" stat. 82 (05). — 1 specimen, in the collection of the Plankton Laboratory, Copenhagen.

Moreover from the "Michael Sars" 1910:

a) — Lat. 57°41′ N., Long. 11°48′ W., between the Hebrides and Rockall. August 6th—7th 1910.

a

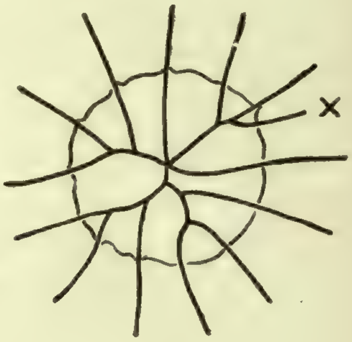


b

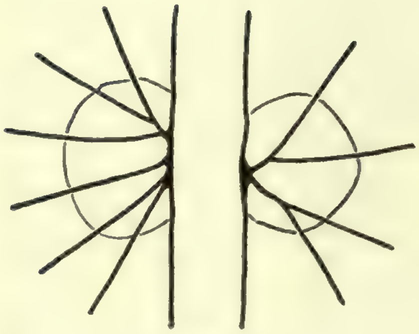
c

d

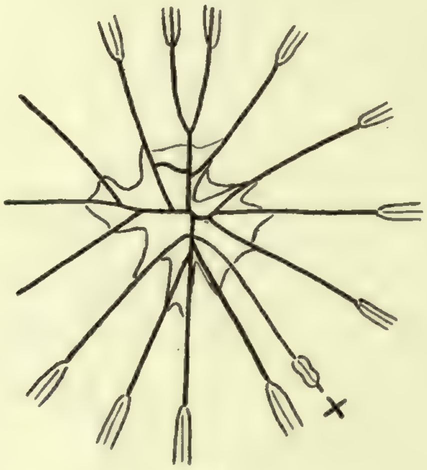
e



f



g



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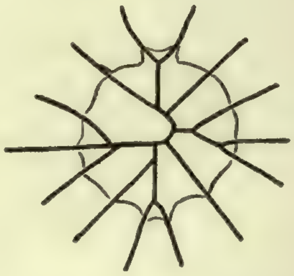

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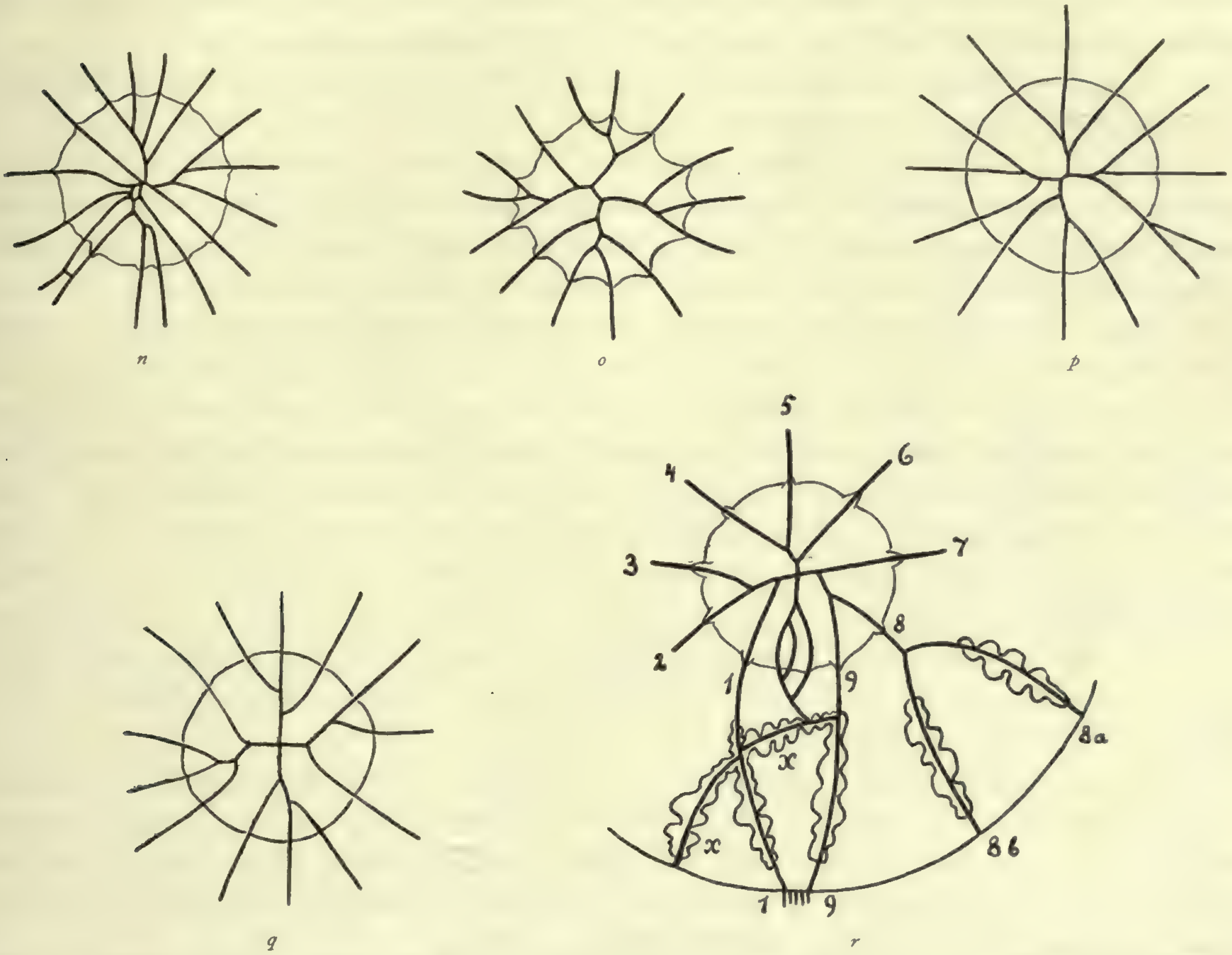

Fig. 9 *a—r*. *Halopsis ocellata* A. Agassiz. Diagrams of the stomachs and the proximal parts of the radial canals of different specimens, seen from the apical side. For further explanation, see the text, pp. 71—73.

Depth 1853 m. Stat. 101. — Young-fish trawl, 1000 m wire: 1 specimen. — Ringtrawl, 200 m wire: 1 specimen.

b) — Lat. 56°33′ N., Long. 9°30′ W., south-west of the Hebrides. August 5th 1910. Depth 1000—1360 m. Ringtrawl, 200 m wire. Stat. 98. — 1 specimen.

c) — Lat. 56°15′ N., Long. 8°28′ W., between the Hebrides and the north coast of Ireland. August 4th 1910. Depth 139 m. Ringtrawl, 50 m wire. Stat. 97. — 2 specimens.

d) — Lat. 50°13′ N., Long. 11°23′ W., south-west of Ireland. July 26th 1910. Depth 1565 m. Ringtrawl, 1500 m wire. Stat. 94. — 1 specimen.

Remarks on the individuals.[1]

Loc. 1. — Specimen No. I (textfig. 9 *a*): Diameter about 30 mm, ♂, 14 radial canals, regularly arranged in 4 groups of 3-3-4-4 canals. — Specimen No. II (textfig. 9 *b*): Diam. 35 mm, ♀, 17 radial

[1] The individuals from Loc. a, b, c, and d are mentioned in my paper on the Anthomedusæ and Leptomedusæ from the "Michael Sars" North-Atlantic Expedition in 1910.

canals, two of which are not separated until so far outside the periphery of the stomach that their gonads are confluent (Plate IV, fig. 5); the canals are very irregularly arranged.

Loc. 2. — (textfig. 9 *c*): Diam. 24 mm, ♀, 17 radial canals, one of which (x) is quite young and terminates blindly; arrangement irregular.

Loc. 3. — Specimen No. I (textfig. 9 *d*; Plate IV, figs. 1 and 3): Diam. 35 mm, ♂, mature, 15 radial canals, regularly arranged in 4 groups of 3-4-4-4 canals. — Specimen No. II (textfig. 9 *e*): Diam. 45 mm, ♀, gonads containing eggs of different sizes; 13 radial canals in groups of 3-3-3-4; 442 tentacles (with regard to the distribution of the tentacles in relation to the radial canals, see below).

Loc. 4 (Plate IV, fig. 2): Diam. 35 mm, ♀, 15 radial canals, fairly regularly arranged in groups of 3-3-4-5.

Loc. 5. — Specimen No. I (textfig. 9 *f*): Diam. 25 mm, ♂, 14 radial canals, irregularly arranged, one of the canals (x) is quite young and terminates blindly. — Specimen No. II: Diam. 26 mm, ♂, 17 radial canals, 5-4-4-4, in the third group one small blind canal. — Specimen No. III (textfig. 9 *g*): Diam. 33 mm, ♂; the specimen has 2 stomachs; 6 canals issue from the one of the stomachs, 8 from the other. The distance between the stomachs is 2 mm. The dimensions of the stomachs are, respectively, 3.8 by 3.0 mm and 4.0 by 2.7 mm.

Loc. 6. — Specimen No. I: Diam. 28 mm, ♀, 15 radial canals, 3-5-3-4. — Specimen No. II: Diam. 32 mm. — Specimen No. III: Diam. 36 mm, ♂, 15 radial canals. — Specimen No. IV: Diam. 37 mm. — Specimen No. V: Diam. 40 mm.

Loc. 7. — Specimen No. I (textfig. 9 *h*): Diam. 23 mm, ♂, 15 radial canals, one of which ends blindly (x), but has already a short gonad. — Specimen No. II (textfig. 9 *i*): Diam. 28 mm, ♂, 14 radial canals, 4-4-3-3. — Specimen No. III (textfig. 9 *k*): Diam. 40 mm, ♀, 17 radial canals, 3-4-5-5. Two of the canals, issuing from the periphery of the stomach, make an anastomosis, from which 3 canals issue. In the 2nd group there is a young canal (x) beginning to develop.

Loc. 8. — Specimen No. I (textfig. 9 *l*): Diam. 30 mm, ♀, 16 radial canals, irregularly arranged. — Specimen No. II: Diam. 35 mm, ♂, 15 radial canals, 3-4-3-5. — Specimen No. III: Diam. 35 mm, ♂, 17 radial canals.

Loc. 9. — Specimen No. I: Diam. 30 mm, ♀, 15 radial canals. — Specimen No. II (textfig. 9 *m*): Diam. 30 mm, ♂, 15 radial canals, irregularly arranged. — Specimen No. III (textfig. 9 *n*): Diam. 44 mm, ♂, sexual products spawned, 16 radial canals, irregularly arranged. 428 tentacles and 80 marginal vesicles (see below). — Specimen No. IV (textfig. 9 *o*): Diam. 56 mm, ♀; the individual has spawned, but the gonads still contain some eggs. 14 radial canals, 3-3-4-4. 83 marginal vesicles (see below); the tentacles cannot be counted.

Loc. 10. — Specimen No. I: Diam. 33 mm, ♂, 15 radial canals, 3-3-4-5. Specimen No. II: Diam. 34 mm, ♂, 15 radial canals.

Loc. 11. — Diam. 45 mm, ♀, fully mature, 15 radial canals.

Loc. 12. — Diam. 40 mm, ♂, 12 radial canals, 3-3-3-3.

Loc. 13 (textfig. 9 *p*): Diam. 35 mm, ♀, 13 radial canals, 3-3-3-4.

Loc. 14 (textfig. 9 *q*): Diam. 30 mm, ♂, 13 radial canals, 3-3-3-4.

Loc. 15 (textfig. 9 *r*): Diam. 20 mm, ♀. The radial canals are abnormally arranged. 12 canals leave the periphery of the stomach, 3-3-3-3, and 11 canals reach the circular vessel. One of the quadrants is stunted, pressed between the neighbours; in connection herewith it must be remarked that the specimen is unusually highly arched. The arrangement of the canals is as follows:

Group I. 3 canals (marked 1, 2, and 3 in the figure) leave the stomach and reach the circular vessel (as to No. 1, see below).

Group II. 3 canals (4, 5, 6) leave the stomach and reach the circular vessel in normal way.

Group III. 3 canals (7, 8, 9) leave the stomach. No. 7 reaches the circular vessel normally; No. 8 divides into 8 *a* and 8 *b*, both of which reach the circular vessel. No. 9 runs to the margin and reaches the circular vessel so near No. 1, that there is only room for 3 tentacles between the two canals. On the way towards the margin No. 9 sends out a branch (x), which, crossing No. 1, runs towards the margin and reaches the circular vessel between No. 1 and 2, nearest to No. 1.

Group IV. 3 canals leave the stomach, all very close together, and unite just outside the stomach into one canal, which opens into the link canal x between 9 and 1, nearest to No. 9.

The arrangement of the gonads on the abnormal radial canals is sketched in the figure.

Only in a few cases it has been possible to count the tentacles and marginal vesicles.

Loc. No. 3, specimen No. II (diam. 45 mm) has 442 tentacles, the distribution of which in relation to the 13 radial canals will be seen from the following scheme:

Off the 13 radial canals		13 tentacles
Group I 19 + 49 + 30	=	98 —
— II 25 + 34 + 27	=	86 —
— III 46 + 29 + 34 + 32	=	141 —
— IV 29 + 37 + 38	=	104 —
Total...		442 —

Thus the number of tentacles between two successive radial canals varies, in this specimen, from 19 to 49.

Loc. No. 9, specimen No. III (diam. 44 mm) has 16 radial canals (arrangement irregular), 428 tentacles, and 80 marginal vesicles, distributed between the radial canals in the following manner:

Tentacles.............	10	29	28	16	31	23	25	28	31	20	11	36	28	36	29	31
Marginal vesicles	1	7	6	2	5	4	5	4	8	3	3	6	9	6	5	6

Thus in the present case the number of tentacles between two successive radial canals varies from 10 to 36, the number of marginal vesicles from 1 to 9. The average number of marginal vesicles between two canals is 5.35, the average number of tentacles between two successive marginal vesicles is 5.70. The arrangement of the marginal vesicles is, however, fairly irregular, in so far as two vesicles may be found immediately beside each other.

Specimen No. IV from the same locality (diam. 56 mm) has 14 radial canals (3-3-4-4); the tentacles cannot be counted; there are 83 marginal vesicles, distributed between the radial canals in the following manner:

4 3 5 4 7 8 5 10 3 7 9 5 6 7

The average number of marginal vesicles between two successive radial canals is 5.9, varying from 3 to 10.

The map (Chart IX) demonstrates that the North-European localities, in which this species has been found, fall into two separated groups: 1) south of Iceland, 2) west of the British Isles. Though these areas are very near each other, there seems, however, to exist an obvious difference between the individuals from the two areas, in any case in one regard, in so far as the specimens from Iceland have a greater number of radial canals than the British specimens of corresponding sizes. In Table VII, which serves to elucidate this fact, the specimens collected by the "Michael Sars" in 1910 are included among the specimens from the British area.

Also with regard to the relation between the diameters of the stomach and the umbrella there seems to be a difference between the British and the Icelandic specimens, the stomach being comparatively larger in the former than in the latter.

Table VII. Numbers of radial canals of specimens of different sizes of *Halopsis ocellata*.

Numbers of radial canals	Diameters of specimens from									
	South of Iceland					West of British Isles				
	21—30 mm	31—40 —	41—50 —	51—60 —	Total	21—30 mm	31—40 —	41—50 —	51—60 —	Total
11	.	.	.	.	.	1	.	.	.	1
12	.	.	.	.	.	.	4	.	.	4
13	.	.	1	.	1	2	2	.	.	4
14	3	.	.	1	4	.	.	.	.	.
15	4	6	.	.	10	.	.	1	.	1
16	1	.	1	.	2	.	.	.	.	.
17	2	3	.	.	5	.	.	.	.	.
	Average diameter 33.5 mm Average number of radial canals 15.3 22 specimens examined					Average diameter 34.7 mm Average number of radial canals 12.6 10 specimens examined				

I have measured the stomachs in 21 Icelandic and 10 British specimens, and I give the figures obtained in Table VIII, at the same time as I expressly remark that too much importance must not at present be applied to the results, the material investigated being rather small. The figures look, however, interesting as far as they indicate the existence of two different local races in areas very near each other; if future investigations should confirm this result, it would be of great interest to the studies of the variation of medusæ.

It will be observed from the table that, as far as the smaller and middle-sized individuals are concerned, the figures representing the proportion between the size of the stomach and that of the umbrella exhibit a somewhat considerable difference between the specimens from the two areas. The figures from Iceland show, moreover, that the stomach grows in size nearly proportionately to the umbrella until the latter has reached a diameter of towards 40 mm; at this size the sexual products are mature, partly even spawned (see below); thereafter the umbrella continues its growth, whereas the stomach does not further increase in size.

To the measurements presented in the tables VII and VIII one may object that it is difficult to measure the umbrella exactly, because it is very contractive and may, at the preservation, be contracted to a very different degree. This objection is entirely correct, and we must, therefore, take a certain reservation to the figures of the tables. But, on the other hand, the difference between the Icelandic and the British specimens, as shown by the figures of the tables, both with regard to the diameter of the stomach and the number of the radial canals, is so obvious that it can hardly be due to erroneous measurements owing to different contraction of the umbrella. Moreover, when regarding the absolute figures of the dimensions of the stomach, which can be measured fairly exactly, we will find that in most of the British specimens the stomach is actually larger than in the Icelandic specimens. And a comparison of the two tables (VII and VIII) will give the result that the individuals

Table VIII. Correlation between Diameter of Stomach and Umbrella of *Halopsis ocellata*.

Diameter of umbrella	South of Iceland (21 specim.) Diameter of stomach mm 4	5	6	7	8	Average diameter of umbrella	stomach	Proportion between stomach and umbrella	West of British Isles (10 specim.) Diameter of stomach mm 6	7	8	9	Average diameter of umbrella	stomach	Proportion between stomach and umbrella
20—25 mm...	1	2	.	.	.	24	4.7	0.20	1	1	.	.	21	6.5	0.31
26—30 — ...	1	3	2	.	.	29	5.2	0.18	.	.	1	1	29	8.5	0.29
31—35 — ...	.	.	3	1	3	35	7.0	0.20	.	.	1	2	34	8.7	0.26
36—40 — ...	.	.	.	2	.	38	7.0	0.18	.	.	2	1	40	8.3	0.21
41—45 — ...	.	.	.	2	.	44.5	7.0	0.16	.	.	.	.	—	—	—
56 — ...	.	.	.	2	.	56	7.0	0.13	.	.	.	.	—	—	—

from the area west of the British Isles have, generally spoken, larger stomachs and a smaller number of radial canals, whereas the specimens from the waters south of Iceland have smaller stomachs and a larger number of radial canals, even quite setting aside the total size of the specimens.

The young gonads are straight, but according as the sexual products are developed, the gonads gradually become sinuous; this development commences, when the diameter of the specimen is 20—25 mm. When the individual is 30—35 mm wide the gonads are much thickened and greatly sinuous. The male gonads may have up to 9 bends on either side; the female gonads never become so much thickened or sinuous as the male ones. The maturity is reached, when the animal is about 35 mm wide. Then, in the case of the female, we can see the eggs having penetrated the ectodermal epithelium and being situated freely on the lateral walls of the radial canals, ready to be detached (Plate IV, fig. 4; textfig. 7). When the male gonads become mature, they become much swollen and, besides being sinuous, they get a finely wrinkled surface (Plate IV, fig. 3). — After the ripening and detachment of the sexual products the animal continues its growth. According as the main part of the sexual products are evacuated, the radial canals stretch and become straight again; at the same time the walls are destructed and detached from the subumbrella, only the narrow entodermal stripe, along which the canal was attached to the subumbrella, remaining. The sexual products are first evacuated in the proximal part of the gonads, so that at a certain moment the radial canals are seen attached to the subumbrella by the parts free of gonads and by the distal part of the gonadial part, from which the sexual products are not yet evacuated, while the part, in which the evacuation has been completed, hangs freely downwards like a bow (see the diagram, textfig. 10). Female individuals, which have evacuated the eggs, are found to measure 40—56 mm in diameter; a male specimen, 44 mm wide, has spawned.

Occurrence:

The occurrence of *Halopsis ocellata* at the coast of North America is limited to the Gulf of Maine from Grand Manan to Cape Cod (A. Agassiz, Fewkes, Bigelow).

The distribution on the European side of the North Atlantic is as follows: The species is common all along the south coast of Iceland, mainly in the neighbourhood of the coast. Hitherto it has not been found at the Faeroe Islands. It is common in the waters between Scotland and Rockall, and has been found, moreover, south-west of Ireland. As mentioned above, it has not previously been recorded from the European waters, thus all our knowledge of its occurrence in that area is based on the material here dealt with. It will be observed from chart IX, that it does not at any point surpass the Wyville Thomson ridge. As it has, besides, not been found at the western or northern coasts of Iceland, its distribution may be designated as being entirely Atlantic. The occurrence seems, moreover, to be mainly neritic. Thus during the cruise of the "Armauer Hansen" in 1913 the species was only found on stat. 17, the easternmost station of the expedition, above the deep channel east of Rockall, whereas it was completely absent on all of the westernmore stations.

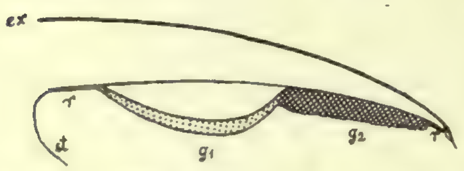

Fig. 10. *Halopsis ocellata* A. Agassiz. Diagram, showing a radial section through the umbrella. — *ex* exumbrella, g_1 part of the gonads, from which the sexual products have been evacuated, g_2 part of the gonads, still containing sexual products, *r*, *r* proximal and distal parts of radial canal free of gonads, *st* stomach.

With regard to the bathymetrical distribution, the data at hand show that the species may be found at very different depths. — The specimens from the south coast of Iceland have all been taken at a fairly short distance below the surface, in no case deeper than about 40 m (with 70 m wire); some of the specimens have undoubtedly been found very close to the surface. The specimens from Loc. No. 10, which is situated comparatively far south of Iceland, were taken with 15 m wire, i. e. close by the surface. — West of Scotland, on the other hand, it has been found, on certain occasions, in considerable depths, thus, for instance, by the "Michael Sars", loc. a, with 1000 m wire. The various depths, in which the species has been found within that area, will be seen from the following figures, representing the length of wire used by the hauls made: 50, 65, 65, 150, 200, 200, 300, and 1500 m, that means between about 30 and about 1000 m below the surface. Of special interest is the station 17 of the "Armauer Hansen", where a specimen was taken in a haul with 150 m wire out, whereas none were found in the deeper hauls (with 600, 1000, and 1300 m wire). — South-west of Ireland 1 specimen was found in a haul with 200 m wire (loc. 15), and 1 specimen in a haul with 1500 m wire ("Michael Sars", loc. d).

The very most of the finds have been made in the months of July and August. West of Scotland it has also, however, been found on May 28th and June 10th, and south-west of Ireland a specimen was taken on June 15th. — Mature specimens have been found both at the end of May and in the summer months. Quite young individuals have not been observed; from the present material we can, therefore, state nothing more with regard to the breeding season, than that the spawning of the eggs may take place during the summer. With regard to the further fate of the eggs and the hydroid generation nothing can be stated.

Genus Tiaropsis L. Agassiz.

This genus was established by L. Agassiz (1849, pp. 289 ff.) for the North American *Tiaropsis diademata* L. Agassiz. — Browne (1910, p. 33) characterises the genus in the following manner: "*Mitrocomidæ* with four radial canals; with eight sensory pits; with an ocellus adjacent to each sense organ; without marginal cirri". — The genus and its species have recently been dealt with by Browne (1910, p. 33) and Bigelow (1913, p. 32).

The genus comprises, probably, 6 species: *multicirrata* Sars in the eastern and western part of the northern Atlantic and in the northern Pacific (*diademata* Agassiz and *multicirrata* Sars are identical, which shall be further demonstrated below); *macleayi* v. Lendenfeld (1884) from Australia; *davisii* Browne (1902) from the Falkland Islands. Common for these three species is the possession of numerous tentacles, all of the same size, whereas the three other species, all of which live in warmer seas, have 4—8 well-developed tentacles and a number of rudimentary ones. The three species are the following: *Tiaropsis rosea* Agassiz & Mayer (1899) from the Fiji Islands (Agassiz & Mayer 1899), Malyan Archipelago (Maas 1905), and Tortugas, Florida (*Tiaropsis diademata* Fewkes 1882, *Tiaropsis punctata* Mayer 1900); *Tiaropsis mediterranea* Metschnikoff (1886) from the Mediterranean; *Tiaropsis kelseyi* Torrey (1909) from the San Diego region, Pacific coast of North America.

The genus *Tiaropsis* has, thus, a very extensive geographical distribution.

Tiaropsis multicirrata (M. Sars.)

Plate IV, figs. 6, 7, 8, 9, 10; textfigs. 11, 12, 13, 14.

Thaumantias multicirrata M. Sars 1835. Beskrivelser og Iagttagelser ... — p. 26. Pl. 5, fig. 12 a—c.
— *melanops* Forbes 1848. British Naked-eyed Medusæ. — p. 45. Pl. X, fig. 3.
Tiaropsis diademata L. Agassiz 1849. Contrib. Nat. Hist. of the Acalephæ of North America. — p. 289. Pl. 6, figs. 1—18; Pl. 8, fig. 11.
Thaumantias eschscholtzii Haeckel 1879. System der Medusen. — p. 129. Taf. VIII, fig. 4.

Bell flatter than a hemisphere, about 20 mm wide, gelatinous substance not very thick. Stomach fairly small, provided with 4 folded lips; there is a broad, flat stomachal peduncle. 4 straight radial canals, carrying the gonads, which extend from the base of the stomachal peduncle nearly to the circular vessel. About 300 short tentacles with well developed basal bulbs. 8 adradial, open marginal vesicles, each containing about 12 concretions; at the base of each marginal vesicle there is a large, black ocellus. Velum well developed. Stomach and gonads yellowish; the tentacular bulbs contain an entodermal pigment mass and are also provided with fine ectodermal pigment granules.

The particular aim of my studies on this species has been to elucidate the relation between the European form *Tiaropsis multicirrata* M. Sars and the American *Tiaropsis diademata* L. Agassiz, the identity of which appears to be beyond doubt.

Before I enter on a discussion of that question I shall, however, communicate the interesting fact, that "*Thaumantias eschscholtzii*" Haeckel appears to be identical with *Tiaropsis multicirrata. Thaumantias eschscholtzii* was described and figured by Haeckel in his System der Medusen and has frequently, in text books and manuals, been mentioned as a typical *Thaumantias*. Haeckel's description was based on some specimens from Greenland in the Zoological Museum of Copenhagen. I have seen these specimens and found that the large, black ocelli are so conspicuous, that it seems incomprehensible, how they have escaped the attention of Haeckel, when he examined the individuals in order to describe them. The specimens are certainly the same, which were examined by Haeckel, and not some others, erroneously identified by another person. This is clearly demonstrated by the label being provided with a number referring to a list of the collection of medusæ, then in the museum

Fig. 11.

Fig. 12.

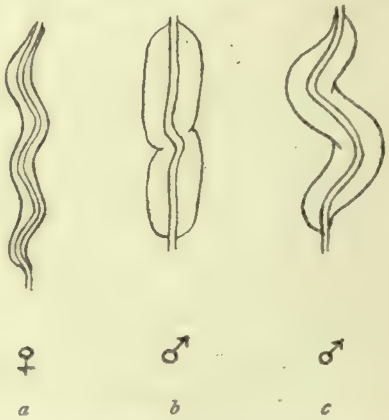

Fig. 13.

Fig. 11. *Tiaropsis multicirrata* Sars. Mouth-lips of a young specimen, 1.5 mm wide. — Fig. 12. *Tiaropsis multicirrata* Sars. Diagram of a young specimen, 1.8 mm wide. — Fig. 13. *Tiaropsis multicirrata* Sars. Radial canals with gonads. *a* female, *b* and *c* male.

of Copenhagen, written by Haeckel with his own hand. Another specimen, from Egedesminde, West Greenland, has been referred by Levinsen (1892) to the species of Haeckel, and I myself, seing that the specimens collected by the "Tjalfe" expedition quite agreed with the description and figures of Haeckel, I referred them, unfortunately, to "*Thaumantias eschscholtzii*" without closer examination (Kramp 1913, p. 267 and 1914, p. 419).

Morphological remarks:

The base of the stomach is cross-shaped. In quite young individuals (diameter 1.5—2 mm) the mouth-lips are egg-lancet-shaped, entire, without folds (textfig. 11, from a specimen, 1.5 mm wide, from Trangisvaag at the Faeroe Islands). Later they become much folded and are besides, in large specimens, rather much lobated. There is a stomachal peduncle, very short and broad, but distinctly marked from the subumbrella. Young specimens (when about 2 mm wide) have no stomachal peduncle, the future presence of which is however indicated by a flattened area in the upper part of the subumbrella, whereas the exumbrella is evenly rounded on the top (see the diagrammatic figure, textfig. 12, drawn from a specimen, 1.8 mm wide, from Trangisvaag, Faeroe Islands).

The gonads always commence at or very near the base of the stomachal peduncle (Plate IV, figs. 9 and 10) without relation to the developmental stage of the individual. The distance from the distal end of the gonads to the circular vessel, on the other hand, depends on the developmental stage.

The female gonads are sinuous, with 2—3 bendings towards either side (textfig. 13 *a*). The male gonads are thick, cylindrical, only provided with a single constriction or bend near the middle (textfig. 13 *b*), more seldom with a couple of bends (textfig. 13 *c*). — In the gonadial part of the radial canals the gonads occupy the lateral walls from the subumbrella nearly to the ventral edge, leaving only a very narrow edge to separate the gonads of the two sides (see Plate IV, fig. 6, representing a transverse section of a radial canal with male gonads). Plate IV, figs. 7, 8, 9, and 10 represent the female gonads. It will be observed that the eggs are placed in the ectoderm in a single layer; fig. 7 is a transverse section of a canal with unripe eggs; in fig. 8 the eggs are mature, and some of them have penetrated the ectodermal epithelium; several eggs have already been detached; figs. 9 and 10 represent mature female gonads, the ripe eggs situated closely side by side on the outer surface of the lateral walls of the canal, ready for deliberation. In the gonadial part the radial canal is much compressed laterally, having a high and narrow lumen.

The size of the individuals, when the sexual products become mature, is somewhat variable. In a few cases I have found fully mature specimens being 10—12 mm wide, but as a rule the maturity does not seem to be reached until the diameter of the animal is 14—15 mm. I have seen female individuals, which have deliberated their eggs, with the following diameters: 15, 16, and 18 mm (all from Iceland).

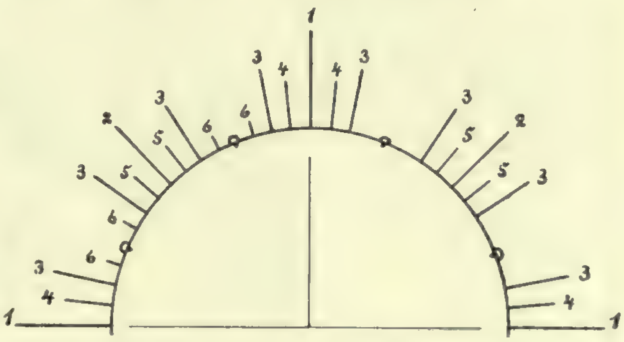

Fig. 14. *Tiaropsis multicirrata* Sars. Diagram, showing the succession in the development of the tentacles. From a specimen, 1.5 mm wide, with 47 tentacles.

The marginal vesicles and the ocelli have been examined by Böhm (1878) and Linko (1900). The concretions are, as a rule, placed in a single bow-shaped row; not seldom, however, one or more of the concretions are pushed out from the row, so that there may even be two rows. The concretions are large, globular, or somewhat angular owing to mutual pressure. They are placed closely side by side. As a rule most of them are of equal size, only the outermost on both sides being smaller (younger); not seldom there is a very tiny concretion at one of the outer ends of the row. Accordingly the concretions seem to be formed and developed from the middle of the row outwards.

A specimen from Trangisvaag, Faeroe Islands (locality No. 20 b in the list below), 1.5 mm in diameter, has 47 tentacles, the sizes and arrangement of which clearly indicate the succession in which the tentacles are developed. The facts are represented in the diagrammatic figure, textfig. 14. The diagram agrees very well with that given by A. Agassiz (1863) for *Tiaropsis diademata*, though I am not sure, whether No. 4 and 5 may not be of the same age. The position of the marginal vesicles corresponds to that of a third series of tentacles, and possibly the marginal vesicles actually have to be regarded as being homologous with as many tentacles. Thus the formula for the first 40 tentacles in the present specimen is as follows: $4t_1 - 4t_2$ (+ 8 marginal vesicles) $+ 16t_3 + 8t_4 + 8t_5$, or, if t_4 and t_5 are of the same age: $4t_1 + 4t_2$ (+ 8 marginal vesicles) $+ 16t_3 + 16t_4$. — The tentacles are densely crowded on the bell margin, and not seldom two successive tentacular bulbs are more or less coalesced. In the countings of tentacles, mentioned below, two such tentacles with coalesced bulbs are always counted as two tentacles. The number of tentacles in different specimens of equal size is very variable (see below). The greatest number, which I have observed, is 328, found in a specimen, 15 mm wide, from Dyrefjord, Iceland (Loc. No. 18 c).

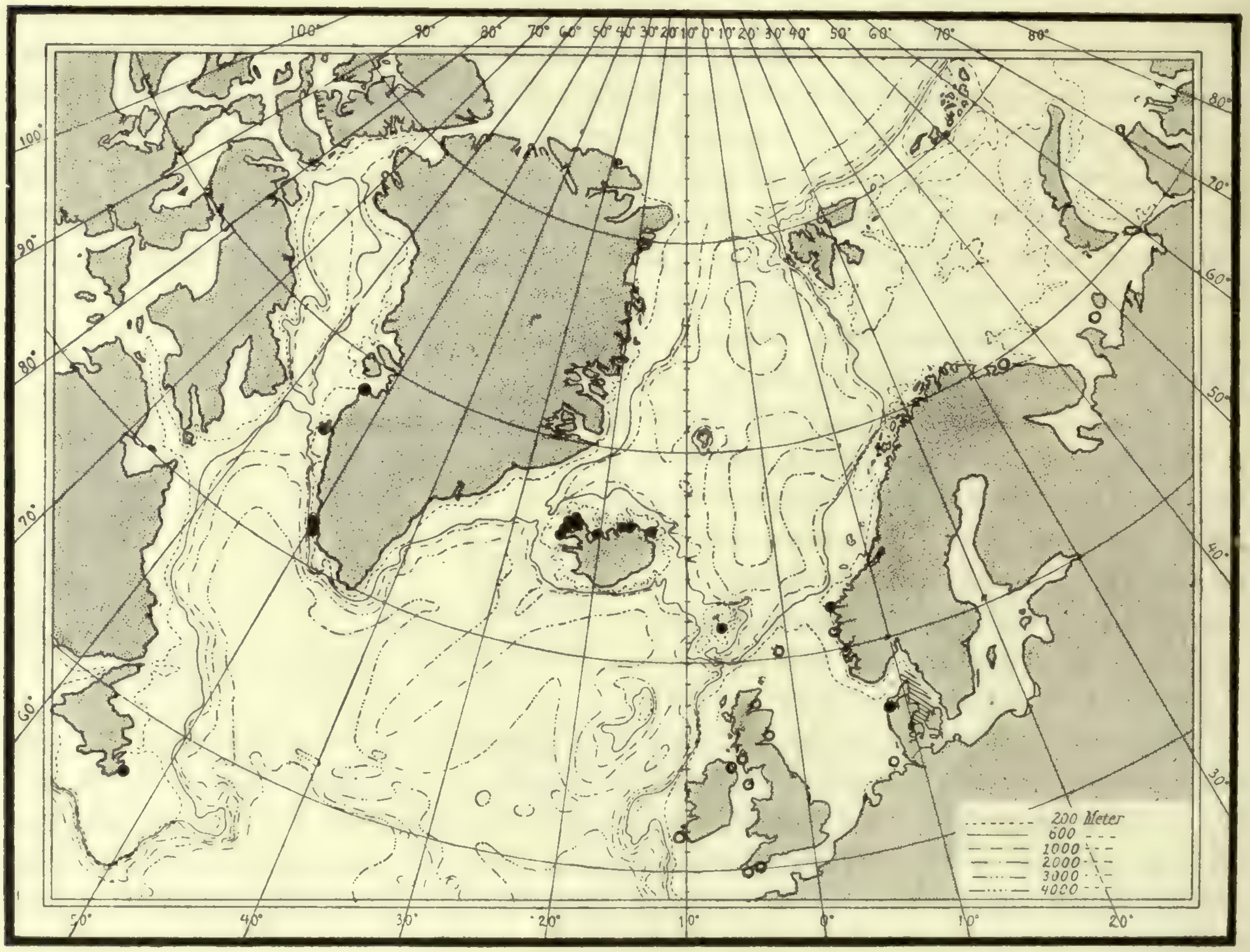

Chart X. Occurrence of *Tiaropsis multicirrata* M. Sars in the northern Atlantic and adjacent waters.
o Occurrence according to the literature.

Material (see Chart X):

West Greenland:

1) — Greenland, Holbøll (1841). — 1 specimen. Type specimen of *Thaumantias eschscholtzii* Haeckel.

2) — Greenland (1865). — 2 specimens, labelled *Thaumantias eschscholtzii.*

3) — Egedesminde, Bergendal (1890). — 1 specimen.

4) — Lat. 66°11′ N., Long. 54°27′ W., off Søndre Strømfjord. August 28th 1908. Ringtrawl, 80 m wire. "Tjalfe" stat. 221. — 1 specimen, 15 mm wide.

5) — South of Northern Storø near Frederikshaab. July 2nd 1909. Depth 265 m. Ringtrawl, 100 m wire. "Tjalfe" stat. 502. — 18 specimens 6—10 mm wide.

6) — Frederikshaab harbour. July 8th 1909. Surface. "Tjalfe" stat. 519. — Several hundreds of specimens, the smallest being about 6 mm wide; most of the specimens are 10—14 mm wide.

New Foundland:

7) — St. Johns. July 5th 1910. Surface. "Michael Sars" 1910. — 37 specimens, from 6 mm in diameter; most specimens are 10—12 mm wide. In Bergens Museum.

Iceland:

8) — Lat. 66°17′ N., Long. 14°27′ W., near Cape Langenæs. July 20th 1904. Depth 77 m. Young-fish trawl, 80 m wire. "Thor" stat. 203 (04). — 1 specimen, 13 mm wide.

9) — Axarfjord. August 12th 1903 Depth 38 m. Young-fish trawl about 1 m below the surface. "Beskytteren", Otterstrøm. — 1 specimen, 12 mm wide.

10) — Lat. 66°14′ N., Long. 17°28′ W., off Skjalfandifjord. July 21st 1904. Depth 200 m. "Thor" stat. 208 (04). — 14 specimens, 11—18 mm wide.

11) — Ingolfsfjord. July 13th 1902. "Diana", A. Ditlevsen. — 5 specimens, 7—13 mm wide.

12) — Hesteyrifjord. June 25th 1902. Surface. "Diana", A. Ditlevsen. — 115 specimens, 5—13 mm wide, most specimens 10—12 mm.

13) — Veidileysafjord. June 26th 1902. Surface. "Diana", A. Ditlevsen. — 6 specimens.

14) — Mouth of Hrafnsfjord. June 27th 1902. "Diana", A. Ditlevsen. — 18 specimens, 7—12 mm wide.

15) — Skutilsfjord. June 5th 1892. Lundbeck. — 9 specimens, 2—5 mm wide.

16) — Isafjord. June 6th 1895. "Ingolf". — 42 specimens, 3—9 mm wide; most specimens 3—5 mm. 24 of these specimens are treated with osmic acid.

17) — Ønundarfjord. July 20th 1892. Lundbeck. — 4 specimens, 11—16 mm wide.

18) — Dyrefjord:

a. July 14th 1892. Lundbeck. — 16 specimens, 7—12 mm wide.

b. June 1st 1895. "Ingolf". — 33 specimens, 2—5 mm wide.

c. August 4th 1895. "Ingolf". — 3 specimens, 11—15 mm wide.

19) — Patréksfjord. June 22nd—23rd 1904. Surface, fished from the ship. "Thor" stat. 159 (04). — 4 specimens, 10—11 mm wide.

Faeroe Islands:

20) — Trangisvaag:

a. May 3rd 1895. "Ingolf". — 2 specimens, 1.8—3.5 mm wide.

b. May 9th 1895. "Ingolf". — 2 specimens, 1.5—3.5 mm wide.

Norway:

21) — Kalvaag. June 14th 1903. "Michael Sars". — 4 specimens, 11—14 mm wide.

All specimens here mentioned, except those from loc. No. 7, are in the Zoological Museum of Copenhagen.

The investigations, mentioned below, are based on this material and, besides, on material from the Danish waters, *viz.* from: Næs Sound in the Limfjord; north of the Hirtsholme; Frederikshavn; Læsø Channel; Snoghøj in Lillebelt.

As will be seen from the list above, I have had at my disposal for investigation abundance of material from the following regions: New Foundland, West Greenland, Iceland, the Faeroe Islands, Norway, and Denmark. It was reasonable, therefore, to make use of this material in order to examine, whether the European and the American form are to be regarded as distinct species or merely varieties of one and the same species, or whether there might, possibly, prove to be no traceable difference whatever between the two forms.

With regard to the shape and size of the manubrium, the length and position of the gonads, and the shape of the tentacular bulbs, I have been unable to find any differences.

According to the literature, the pigmentation of the tentacular bulbs has been estimated as establishing the main difference between *Tiaropsis diademata* and *multicirrata.* Mayer (1910, pp. 258 and 259) expresses the difference in the following way: *Tiaropsis diademata*: "Entoderm of tentacle-bulbs and of stomach ocher-yellow. Gonads are cream-colored". *Tiaropsis multicirrata*: "... distinguished from the American *T. diademata* by the black entodermal pigment of its tentacle-bulbs". "Entoderm of gonads, stomach, and bell-margin dull-yellow. Ocelli and pigment of tentacle-bulbs black." — Bigelow (1913, p. 32) states as follows with regard to *Tiaropsis diademata*: "The fact that *diademata* lacks tentacular ocelli has been established on great numbers of specimens, but the tentacular bulbs are not altogether without pigment, for in all the numerous specimens which I have studied they contain a small amount of entodermic pigment of a pale greenish or yellowish-brown color", and with regard to *multicirrata* that, according to the figures at hand, they have "the same entodermic pigment, only in much denser masses, and black instead of pale greenish". With regard to the specimens from the northern Pacific, examined by him, Bigelow states as follows (p. 33): "the entoderm of each bulb contains pale greenish, or in some cases greenish-brown, pigment, in a roughly triangular mass"; this pigment is denser than that, which the author has observed in Atlantic specimens of *diademata*, but never black as in *multicirrata.* In a footnote (p. 33) he states that in some specimens from Massachusetts Bay "the tentacular bulbs were densely pigmented with black granules, thus exactly reproducing the European type". These "black granules" probably means the ectodermal pigment granules, which I have likewise found in specimens from both sides of the Atlantic, and which must be well distinguished from the entodermal pigment.

There can be no doubt, but that the pigment may disappear to a greater or lesser extent owing to the preservation. I have seen specimens from Greenland, Iceland, the Faeroe Islands, Norway, and Denmark, preferably when preserved in alcohol, which have retained no other pigment than that of the 8 large ocelli at the marginal vesicles. In better preserved specimens, particularly when preserved in formalin, from New Foundland, Greenland, Iceland, and Denmark, fine black granules are nearly always found on the surface of the marginal vesicles and the nematocyst-bearing pads of the tentacular bulbs, i. e. on the adaxial and lateral sides of the bulbs. After clearing in xylol and under high power this pigment appears to consist of accumulations of fine, black granules. Once I conceived the suspicion that these granules might possibly not be pigment, but foreign matters (dirt, particles of china-ink from the labels). Their mode of distribution, however, contradicts such an apprehension, as they are only found in the said places, *viz.* on the nematocyst-pads and on the surface of the marginal vesicles; they are wanting on the bulbs of younger tentacles. Similar dark pigment granules may also be found on the surface of the gonads. In the angle between the gonads and the subumbrella unquestionable particles of dirt of quite another appearance are frequently observed.

It is not always easy to detect the entodermal pigment mass in the tentacular bulbs, and in several cases, when a number of specimens were at hand from one and the same locality, I have been able to find the pigment masses in some specimens but not in others. It is only to be observed when placed above a white support and when lighted from above; it then appears as a triangular mass; as a rule it stands out most distinctly when seen from the adaxial side. Frequently the colour is indeterminable, but in other cases the colour has been very clear and distinct. As mentioned above Bigelow has found the entodermal pigment in the bulbs of American specimens being pale greenish or yellowish-brown. In the specimens, examined by me, from St. Johns, Newfoundland (Loc. 7) the entodermal pigment is yellowish-brown, mostly very clearly visible. In specimens from Greenland, Iceland, and Denmark I have found the same yellowish-brown colour and, frequently, also a distinct green colour in the entoderm of the tentacular bulbs; black entodermal pigment I have never seen.

It appears, accordingly, that the *Tiaropsis* from the whole of the North-Atlantic area from the Danish coasts through the waters round Iceland and Greenland to North-America and from the northern Pacific agree completely with regard to the ectodermal as well as the entodermal pigmentation, and thus the character, which has been considered to be the only important feature separating the two "species", does not hold good.

There can be no doubt, accordingly, but that the European and the American *Tiaropsis* belong to the same species. Still the question may arise, whether there might exist a difference between the specimens from the different regions with regard to the size of the bell, the number and arrangement of the tentacles, and other measurable characters. Regarding this question I have measured the diameter and counted the tentacles in a large number of specimens, in so far as they are sufficiently well-preserved for such purpose. I have found that within each of the areas in question there appears a considerable variation concerning these characters, but that the average figures for the various areas are so near each other, that we can hardly speak about local varieties. As the investigation may possibly have some importance from a variation-statistical point of view, I am going to give a short account of the results.

One of the characters I wanted to examine, was the relation between the number of tentacles and the diameter of the bell. It is evident that measurements of preserved medusæ have to be used with caution, because the individuals always contract at the preservation and not always to the same degree. The figures in the tables (IX and X), representing the diameter, must therefore be used with reservation, but they seem to indicate that the specimens from the different areas agree in the main with regard to the said feature.

In table IX is represented the correlation between the number of tentacles and the diameter of the bell of specimens from the different regions; the general results of the table have been gathered

Table IX. Variation of *Tiaropsis multicirrata.*

Correlation between the number of tentacles and 1) the diameter of the specimens, 2) the quantity $\frac{p}{i}$.

Number of tentacles, about	Diameter of specimens, mm															Total	Average diameter, mm	$\frac{p}{i}$								Total	Average of $\frac{p}{i}$
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5		
Denmark.																											
150	.	.	2	1	1	.	.	1	3	.	1	.	.	.	.	9	7.8	1	1	.	3	1	1	1	1	9	1.02
200	.	.	.	3	1	2	1	2	3	7	12	6	1	2	1	41	11.0	.	8	11	16	4	2	.	.	41	1.05
250	.	.	.	.	.	.	1	.	3	.	.	3	2	2	.	11	12.3	.	.	4	.	3	4	.	.	11	1.16
Total number of specimens	.	.	2	4	2	2	2	3	9	7	13	9	3	4	1	61		1	9	15	19	8	7	1	1	61	1.09 ± 0.14
Faeroe Islands and Norway.																											
50	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2.0	.	1	.	1	.	.	.	.	2	1.00
100	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	..	.	.	.	.	.	.	.	.	.	...
150	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	4.0	.	.	.	.	.	.	1	.	1	1.40
200	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	1	11.0	.	.	.	.	.	.	.	.	.	...
250	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	3	14.0	.	.	.	1	.	.	.	.	1	1.10
Total number of specimens	2	.	1	.	.	.	.	.	.	1	.	.	3	.	.	7		.	1	.	2	.	.	1	.	4	1.125 ± 0.18
Iceland.																											
50	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	2.0	.	.	.	1	.	.	.	.	1	1.10
100	2	1	.	.	.	.	.	.	.	.	.	.	.	.	.	3	2.3	.	.	.	1	1	1	.	.	3	1.20
150	.	.	2	.	1	2	.	.	.	.	.	.	.	.	.	5	5.6	1	.	1	1	.	1	1	.	5	1.12
200	.	.	.	.	.	1	.	.	1	.	.	.	.	.	.	2	8.5	.	1	1	.	.	.	.	.	2	0.95
250	.	.	.	.	.	1	.	1	1	2	1	1	.	1	1	9	11.6	.	1	.	2	2	1	1	1	8	1.21
300	.	.	.	.	.	.	.	.	.	.	1	2	.	.	.	3	12.7	.	.	.	1	1	1	.	.	3	1.20
350	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	15.0	.	.	.	1	.	.	.	.	1	1.10
Total number of specimens	3	1	2	.	1	4	.	1	2	2	2	3	.	2	1	24		1	2	2	7	4	4	2	1	23	1.16 ± 0.17
Greenland.																											
100	.	.	.	1	1	1	.	.	.	.	.	.	.	.	.	3	6.0	.	.	.	.	.	.	.	.	.	...
150	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	2	7.0	1	.	1	.	.	.	.	.	2	0.90
200	.	.	.	.	.	.	.	.	1	1	.	.	1	.	.	3	11.7	.	1	2	.	.	.	.	.	3	0.97
250	.	.	.	.	.	.	.	.	.	.	1	.	2	1	.	4	13.8	.	2	1	.	1	.	.	.	4	1.00
Total number of specimens	.	.	.	1	1	3	.	.	1	1	1	.	3	1	.	12		1	3	4	.	1	.	.	.	9	0.97 ± 0.11
New Foundland.																											
200	.	.	.	.	2	1	1	2	.	.	.	.	.	.	.	6	7.5	.	2	3	1	.	.	.	.	6	0.98
250	.	.	.	.	.	.	.	1	3	3	4	.	.	.	.	11	10.9	2	2	3	3	1	.	.	.	11	0.99
300	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	3	12.0	1	.	.	2	.	.	.	.	3	1.00
Total number of specimens	.	.	.	.	2	1	1	3	3	3	7	.	.	.	.	20		3	4	6	6	1	.	.	.	20	0.99 ± 0.11

Table X. Synopsis of the Results, obtained from Table IX.

Number of tentacles, about	Average diameter, mm				
	Denmark	Faeroe Islands and Norway	Iceland	Greenland	New Foundland
50	. .	2.0	2.0	...	...
100	...	...	2.3	6.0	...
150	7.8	4.0	5.6	7.0	...
200	11.0	11.0	8.5	11.7	7.5
250	12.3	14.0	11.6	13.8	10.9
300	...	...	12.7	...	12.0
350	...	...	15.0	...	. .
Number of specimens examined	61	7	24	12	20
	Values of $\frac{p}{i}$				
Lowest value of $\frac{p}{i}$	0.82	0.85	0.81	0.75	0.78
Highest — - -	1.50	1.40	1.54	1.22	1.22
Average — - -	**1.09**	**1.12**	**1.16**	**0.97**	**0.99**
Standard deviation	± 0.14	± 0.18	± 0.17	± 0.11	± 0.11
Number of specimens examined	61	4	23	9	20

in table X. The columns of this table give the average diameter of specimens with so and so many tentacles. The differences between the figures for the various regions are not larger, but that they may be due to casual variation and different degree of contraction. This is most obviously seen, when the figures are represented by curves, one curve representing the results for each of the areas (textfig. 14). The 5 curves cut each other in a quite irregular manner in different points, at the same time as their courses are mainly alike.

A feature, which may be characterised by means of mere countings, being independent on contraction or other phenomena produced by preservation, is the situation of the marginal vesicles in relation to the tentacles. A numeral expression of this situation may be attained in the following manner. In each individual we count the number of tentacles situated between the two marginal vesicles of one and the same quadrant (i. e. around the interradials of the animal), and the number of tentacles between the two marginal vesicles situated on either side of one and the same radial canal (i. e. around the perradials of the animal). When one of the figures found is divided by the other, we obtain a numeral expression of the place of the marginal vesicles in the specimen in question. For the sake of brevity I use the letter i to represent the number of tentacles in the interradial spaces between the marginal vesicles, whereas the letter p represents the number of tentacles in the perradial spaces. Then I operate with the quantity $\frac{p}{i}$. This quantity appears to be highly variable. One should expect it to keep tolerably near 1, but as will be seen from the table, the value may vary between about 0.8 and 1.5 within one and the same locality. It will be seen from table IX that there is no correlation between $\frac{p}{i}$ and the absolute total number of tentacles. Table X gives the average value of $\frac{p}{i}$ within each of the geographical regions, the standard deviation, and the lowest and highest values found. According to the table a difference between the East- and West-Atlantic specimens seems actually to exist with regard to the quantity $\frac{p}{i}$, in so far as the average value as well as the extremes of the series of variation are distinctly lower as far as the specimens from the two western areas are concerned than in the case of the specimens from the three eastern areas. That means that the marginal vesicles are placed somewhat nearer to the radial canals in the specimens from the western Atlantic than in the specimens from the eastern Atlantic area. The standard deviations are, however, so large that we cannot state at present, whether this result rests on a real fact or whether it is merely casual.

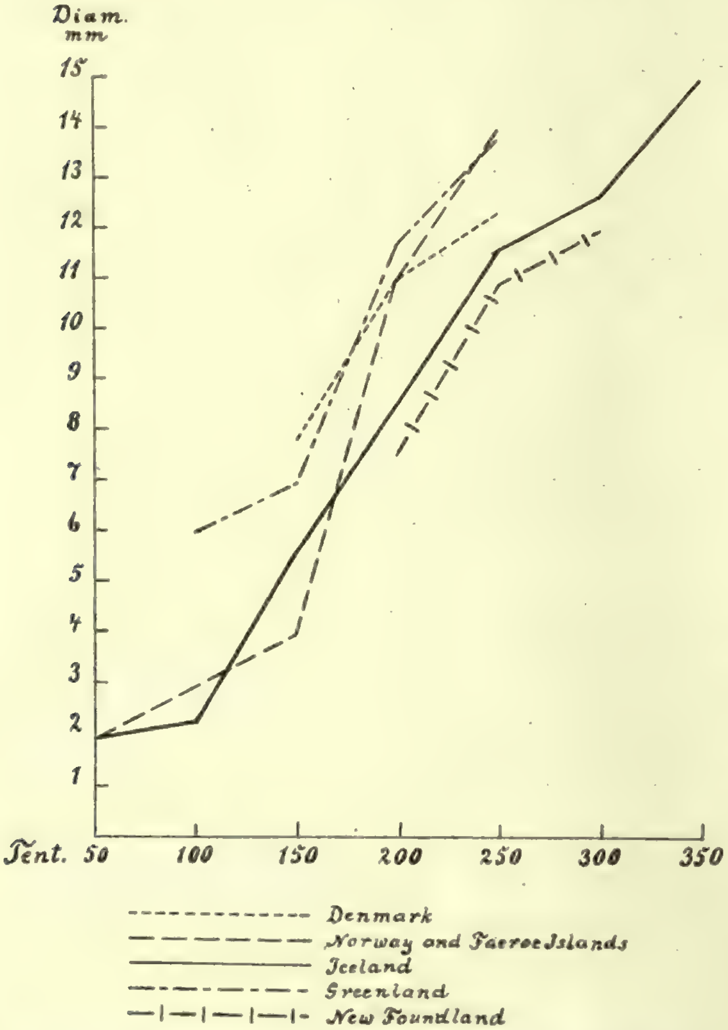

Fig. 15. *Tiaropsis multicirrata* Sars. Curves showing correlation between the diameter of the specimens and the number of tentacles within different geographical areas.

Distribution and Occurrence.

Tiaropsis multicirrata has a fairly wide distribution in the North-Atlantic area. Its occurrence is distinctly neritic.

It is very common at the Atlantic coast of North-America from Eastport to Cape Cod (L. Agassiz 1849, A. Agassiz 1865, Bigelow 1912, 1914 a, 1915). Within that region it occurs during the spring from March to May or the beginning of June. It is met with only occasionally south of Cape Cod, penetrating as far as Woods Hole (Nutting 1901, Hargitt 1902 and 1904).

At the west coast of Greenland *Tiaropsis multicirrata* has been found on several localities near the shore (see chart X), as far northwards as Egedesminde (loc. 3). With regard to the occurrence on loc. 4, 5, and 6 (the stations of the "Tjalfe" expedition) I shall make the following remarks: On stat. 221 (loc. 4), August 28th 1908, a specimen was taken about 50 m below the surface; in an adjacent place the temperature of the water was found to be evenly decreasing from 4°.78 at the surface to 0°.63 near the bottom (128 m); about 50 m below the surface the temperature was about 2°, the salinity about 33 ‰. In 1909 the species was found on July 2nd and 8th very near the shore in the neighbourhood of Frederikshaab (stat. 509 and 519), at both occasions in large numbers and in water of low, though positive temperature. On stat. 509 (depth 265 m) 18 specimens were found about 60—65 m below the surface; the temperature was: in 50 m 0°.42, in 75 m 0°.14, the salinity was 32.5—33 ‰. On stat. 519 (depth 406 m) several hundreds of specimens were taken at the surface at a temperature of 0°.83; in 10 m depth the temperature was ÷ 0°.10, whence it was slowly increasing towards the bottom. — The occurrence of *Tiaropsis multicirrata* in the Greenland waters must, probably, be regarded from the point of view, that the species is strictly neritic and, therefore, does not occur in the Atlantic water-masses in the deep parts of the Davis Strait, being restricted to the coastal regions where the water is very cold during the main part of the year, except in the deeper strata in certain fjords. Not until rather late in the summer, when the effects of the Polar Current are comparatively slight, and the surface of the sea is lighted by the sun during the greater part of the twenty-four hours, the upper water layers attain a tolerably high temperature. In agreement herewith *Tiaropsis*, which disappears from the coasts of New England as early as in May, occurs at the Greenland coasts in the middle of the summer. Most of the individuals found are large, mature or near maturity; probably the young specimens live in the deeper, warmer strata in the fjords earlier in the summer. The fact that the species occurs in this area in the warmest part of of the summer, while in other regions it is found in the spring, and the fact that it has not hitherto been found in water of negative temperature, agree very well with our knowledge of the occurrence of the species in other regions, *viz.* that it is a boreal species and avoids warm as well as ice-cold water.

Tiaropsis multicirrata has a fairly wide distribution at the coasts of the British Isles, but nowhere it seems to occur in any great abundance. It has been found at the Shetland Islands ("*Thaumantias melanops*", Forbes), in Cromarty Firth ("*Tiaropsis oligoplocama*", Romanes), west-coast of Scotland, Port Erin, Belfast on Ireland ("*Thaumantias pattersonii*" Greene), Valencia Harbour, Falmouth, and Plymouth; in the southern of those places it has only been found occasionally. — The data regarding the seasons of the finds demonstrate that the species appears at the British coasts in the early spring, at the end of March, and disappears in May, seldom as late as in June. Browne (1895, 1900, 1905 a) has found quite young specimens at the end of March and in April in Firth of Clyde, at Port Erin, and at Valencia Harbour.

Tiaropsis multicirrata has been found at Heligoland by Böhm (1878, p. 184, in great abundance in April, never in the summer) and by Hartlaub (1894, p. 192, from March 3rd to April 12th, being most common at the end of March).

It seems to be a regular visitor to the Danish waters in the spring; it has frequently been found in the northern part of the Kattegat, and in May 1915 I found some few specimens in Lillebelt. The Danish finds are altogether from the end of April and the first half-part of May; large specimens have been taken in the middle of May.

We know very little about the distribution of *Tiaropsis multicirrata* along the coast of Norway. M. Sars (1835) found it in the neighbourhood of Bergen; moreover it has been found at Kalvaag south of Stat in June 1903 (loc. 3, also mentioned by Broch 1905, p. 7).

It occurs in the Barents Sea (Linko 1900 and 1904 b), most commonly in the eastern part between Kanin and Kolguev Island; in the western part of the Barents Sea it is met with only occasionally.

Near Trangisvaag on the Faeroe Islands some few specimens were found by the "Ingolf" expedition at the beginning of May 1895 (loc. 20).

The occurrence at the coasts of Iceland is peculiar. As will appear from the above list of localities, *Tiaropsis multicirrata* has been found on several Icelandic localities, all of which are on the north coast or in the fjords of the north-western part of the country. As the species lives at the British, Norwegian, and Danish coasts, one should also expect it to occur at the southern and western coasts of Iceland and not to be restricted to the north coast, where the water is distinctly colder. By a more thorough examination of the facts we may, however, find a natural, though hypothetical, explanation of the fact here mentioned. First we must pay attention to the currents around the Icelandic coasts. The northern branch of the Gulf Stream runs towards the south coast of Iceland and turns in a westerly direction (the Irminger Current), running towards the west along the south coast, towards the north along the west coast, and towards the east along the north coast, its power and effects gradually decreasing. The Polar Current, coming from the Polar Sea, strikes the north-east point of Iceland (Cape Langenæs) and divides into two branches; the left branch runs towards the south along the east coast of Iceland, meeting the above mentioned northern branch of the Gulf Stream over the Wyville Thomson ridge; thereby the warm current is forced towards the west, the cold current towards the east; there may be an extraordinaryly sharp limit between the warm and the cold water near the island Papey on the south-east coast of Iceland. The right branch of the Polar Current bends towards the west, but meets the comparatively warm coastal current and is forced, therefore, to run in some distance from the coast in a direction towards the east coast of Greenland, where it unites with the East-Greenland Polar Current. The distance of the cold water from the north coast of Iceland varies very much according to the season and other circumstances, but during the summer the warm current has usually so much power that the coastal water is comparatively warm all along the north coast as far as Langenæs. There is nothing particular, therefore, in the boreal species *Tiaropsis multicirrata* being able to live in the fjords of the northern coasts of Iceland, and it is quite natural that the species is entirely wanting on the cold east coast; but why has it never been found at the west and south coasts? Now we must remember that in the British and adjacent waters the species has its occurrence in the spring, the young medusæ appearing in March—April, reaching maturity in May. Undoubtedly young *Tiaropsis* might also be found at the south and west coast of Iceland in the spring months, but no collections have been made in Icelandic waters during that season. My hypothesis is, that the medusæ which are deliberated on the south and west coast are carried along by the coastal current to the north coast, where they come at rest in the numerous fjords together with individuals, hatched and developed on the spot; thus the want of material of the species from the south and west coast is due partly to want of collections from the spring time, partly to the comparatively strong current running along these coasts. The finds from the northern coasts of Iceland have been made between June 1st and August 12th. There are a number of young specimens, 2—9 mm wide, from the first days of June, whereas larger individuals have been found during the later half-part of June, and mature specimens at the end of June, during July, and at the beginning of August.

The specimens, mentioned by Bigelow, from the northern Pacific (Dutch Harbour and Agattu Island) were found on May 25th and June 7th; they were altogether well-sized individuals.

We may then state as a general result that *Tiaropsis multicirrata* is a neritic-boreal species, living in the boreal coastal regions in the North Atlantic area and in the northern Pacific. In the greater part of the area of distribution its occurrence is limited to the spring months, the young specimens appearing in March, growing to maturity in May, and disappearing in May or June. In the waters of Iceland and Greenland the season of its appearance falls somewhat later, in accordance with the later commencement of the spring. Young specimens may be found at the northern coasts of Iceland as late as in June, and at Iceland as well as at the west coast of Greenland full-grown specimens may still be met with in August.

Family Eucopidæ Gegenbaur.

Genus Obelia Péron et Lesueur.

Three species of the hydroid genus *Laomedea* producing free-swimming medusæ (*Obelia*) occur in the North Atlantic area, viz. *Laomedea geniculata*, *dichotoma*, and *longissima*, all of which are very widely distributed. Several authors have tried to find characters serviceable for separation of the medusæ of these species, but up to now the results have been very poor. The question has especially been dealt with by Browne. In 1900 he described a new species, *Obelia nigra*, easily recognizable on account of some of the tentacular bulbs (about 6 in each quadrant in full-grown medusæ) being double the size of the others and provided with dark pigment. Browne is now of the opinion that *Obelia nigra* is the medusa of *Laomedea longissima*. Browne has succeeded in rearing the medusæ of the two other species and keeping them alive in aquaria for a considerable time, but he has told me that there is no traceable difference between the medusæ of the two species. I myself has likewise tried to rear the medusæ of the three species of *Obelia* during a stay in Plymouth in 1914. I think that I have found certain characteristical differences between the species in the early stages, but I was not able to make the specimens grow very much in the aquaria, evidently because I did not give them the right kind of food. Later on, in 1916, I have tried to keep *Obelia geniculata* in plunger-aquaria in the laboratory for zoo-physiology in Copenhagen, but here the question of food-supply was still more difficult. Some of the specimens lived in the aquaria for several weeks, but they did not increase in size. I have, however, not yet relinquished all hope but that I shall succeed sometimes in solving the problem of the difference between the three species, but for the present we must leave the matter in abeyance.

In the following I shall give a list of the North-Atlantic material of *Obelia* at my disposal, first recording the specimens which may be referred with certainty to *Obelia nigra*, and then the others which may not at present be specifically identified.

Obelia nigra Browne.

Obelia nigra Browne 1900. Fauna and Flora of Valencia Harbour. — Proceed. Roy. Irish Acad. Ser. 3. Vol. V. — p. 721.

Material:

Iceland:

1) — Lat. 66°17′ N., Long. 14°27′ W., near Cape Langenæs. July 20th 1904. Depth 77 m. Young-fish trawl, 80 m wire. "Thor" stat. 203 (04). — 2 specimens.

2) — Ingolfsfjord. July 12th 1902. "Diana", A. Ditlevsen. — 8 specimens, partly very large.

3) — Hesteyrifjord. June 25th 1902. Surface. "Diana", Ditlevsen. — 9 specimens.

4) — Veidileysafjord. June 26th 1902. Surface. "Diana", Ditlevsen. — 32 specimens.

5) — Mouth of Hrafnsfjord. June 27th 1902. Vertical haul. "Diana", Ditlevsen. — 10 specimens.

6) — Dyrefjord. June 3rd and 6th 1895. "Ingolf". — 5 specimens.

Faeroe Islands:

7) — Kvannesund. May 26th 1902. Surface. "Diana", Ditlevsen. — 37 specimens.

8) — Sørvaag. May 13th 1902. Surface. "Diana", Ditlevsen. — 1 specimen.

9) — Trangisvaag. May 3rd 1895. "Ingolf". — 3 specimens.

British Isles:

10) — Lat. 59°00' N., Long. 3°34' W., at the Orkney Islands. May 21st 1908. Depth 66 m. Surface. "Thor" stat. 2 (08). — 2 specimens.

11) — Lat. 57°36' N., Long. 7°05' W., Little Minch, west of Scotland. May 27th 1908. Depth 90 m. Young-fish trawl, 65 m wire. "Thor" stat. 8 (08). — 12 specimens.

The medusa *Obelia nigra* is previously known from the British Isles (Plymouth, Valencia Harbour, Port Erin, Firth of Clyde, according to Browne 1900, p. 721 and 1905 a, p. 770; M. & C. Delap 1905, p. 12), and from different localities at the Norwegian coast (Browne 1903, p. 16; Broch 1905, p. 7). Moreover it is very common in the Danish waters.

Obelia spp.

Material:

Greenland. Bergendal. — 2 specimens.

Iceland:

Hesteyrifjord. June 25th 1902. Surface. "Diana", Ditlevsen. — 2 specimens.

Skutilsfjord. June 5th 1892. Lundbeck. — 4 specimens.

Dyrefjord. May 30th—June 3rd 1895. "Ingolf". — Altogether 24 specimens, partly treated with osmic acid; some of these specimens probably belong to *Obelia nigra*.

Danmark Strait, near Snefjeldsjøkel on Iceland. June 11th 1895. "Ingolf". — 1 specimen.

Agastra mira Hartlaub.

Mayer 1910, Medusæ of the World, p. 234.

Bell somewhat higher than wide, 1 mm high; gelatinous substance quite thick, with a deep, funnel-shaped depression at the apex. No stomach. 4 narrow radial canals. Gonads irregularly lobated, sack-shaped evaginations on the middle part of the radial canals. The eggs become mature in the entoderm. No tentacles, but 4 minute, pigmented bulbs. Colour of bulbs, gonads, and canals dark-brown. — Abortive medusa of the hydroid *Campanularia integra* Mc Gillivray (syn. *C. caliculata* Hincks).

The medusa has been found in Valencia Harbour, Ireland, and at Heligoland.

Eucope globosa (Forbes).

Mayer 1910, Medusæ of the World, p. 235.

Bell thick-walled, slightly higher than a hemisphere, about 13 mm wide. Manubrium short, whit 4 simple, recurved lips. 4 short, linear gonads, extending from the middle point of the 4 slender radial canals outwards towards the circular vessel. About 32 fairly long tentacles. 8 marginal vesicles, each containing 3—4 or more concretions. Velum well developed. Manubrium, gonads, and tentacular bulbs yellowish or reddish-brown.

This diagnosis is based on specimens, examined by me at Plymouth, and it differs in certain regards from that given by Mayer.

The corresponding hydroid is *Campanulina repens* Hincks.

The medusa is common off the coasts of Great Britain and Holland

Genus Phialidium Leuckart.

Phialidium hemisphæricum (Gronovius).

Plate IV, fig. 14; Plate V, fig. 3. Textfigs. 16 and 17.

Medusa hemisphærica Gronovius 1760. Observationes de animalculis ... Acta Helvetica. Vol. IV. — p. 35.
Thaumantias hemisphærica Forbes 1848. British Naked-eyed Medusæ. — p. 49.
i. p. *Phialidium variabile* Haeckel 1879. System der Medusen. — p. 186.
Phialidium temporarium Browne 1896. On British Hydroids and Medusæ. — Proceed. Zool. Soc. London. — p. 489. Plate XVII, figs. 4, 5, 6.
— *hemisphæricum* Mayer 1910. Medusæ of the World. — p. 266.

For further synonymy, see Browne 1896 and Mayer 1910.

Bell nearly hemispherical, 20—25 mm wide; gelatinous substance thin. Manubrium small, with 4 simple lips. 4 slender radial canals. Gonads oval or linear, their length very much varying; they are placed along the radial canals, somewhat nearer to the circular vessel than to the manubrium. 30—58 long tentacles with somewhat swollen basal bulbs. Usually 2 marginal vesicles between every successive pair of tentacles, each vesicle containing one concretion. Velum fairly narrow. Stomach, gonads, and tentacular bulbs yellowish-brown or reddish-brown.

Among the numerous species of *Phialidium* described, two species are recorded as occurring in the North-Atlantic area, *viz. Phialidium hemisphæricum* (Gronovius), about 20 mm in diameter, with up to 39 tentacles (according to Browne; as to the Icelandic specimens, see below), usually with 2 marginal vesicles between every successive pair of tentacles, and with linear, elongate gonads on the outer halves of the radial canals; and *Phialidium buskianum* (Gosse) Browne, up to 6 mm in diameter, with 20—32 tentacles, with one, sometimes 2, marginal vesicles between every successive pair of tentacles, and with short, oval gonads between the middle of the radial canals and the circular vessel.

I am very much inclined to think that these two species cannot be kept apart. But the North-Atlantic material at my disposal cannot serve as foundation for a discussion of the matter. The Zoological Museum of Copenhagen possesses, however, a very large material of *Phialidium* from the Danish waters and, moreover, a great many specimens, which I brought home from Plymouth in 1914. I consider it most convenient, therefore, to postpone a thorough discussion of the variation of *Phialidium* and the question of the limitation of the species, until that material has been further examined. In the present paper I shall restrict myself to give some information concerning the present material.

Material (see Chart XI):

Iceland:

1) — South of the Myrdalsjøkel. August 17th 1903. "Michael Sars". — 9 specimens, 8—16 mm wide.

2) — Myri Bugt. July 27th 1904. "Beskytteren", Gemzøe. — 6 large specimens.

3) — Lat. 64°04' N., Long. 15°48' W., Myri Bugt. July 24th 1904. Depth 49 m. Young-fish trawl about 28 m below the surface. "Beskytteren", Gemzøe. — 20 specimens, one of which is 7 mm wide, while the others are 13—25 mm.

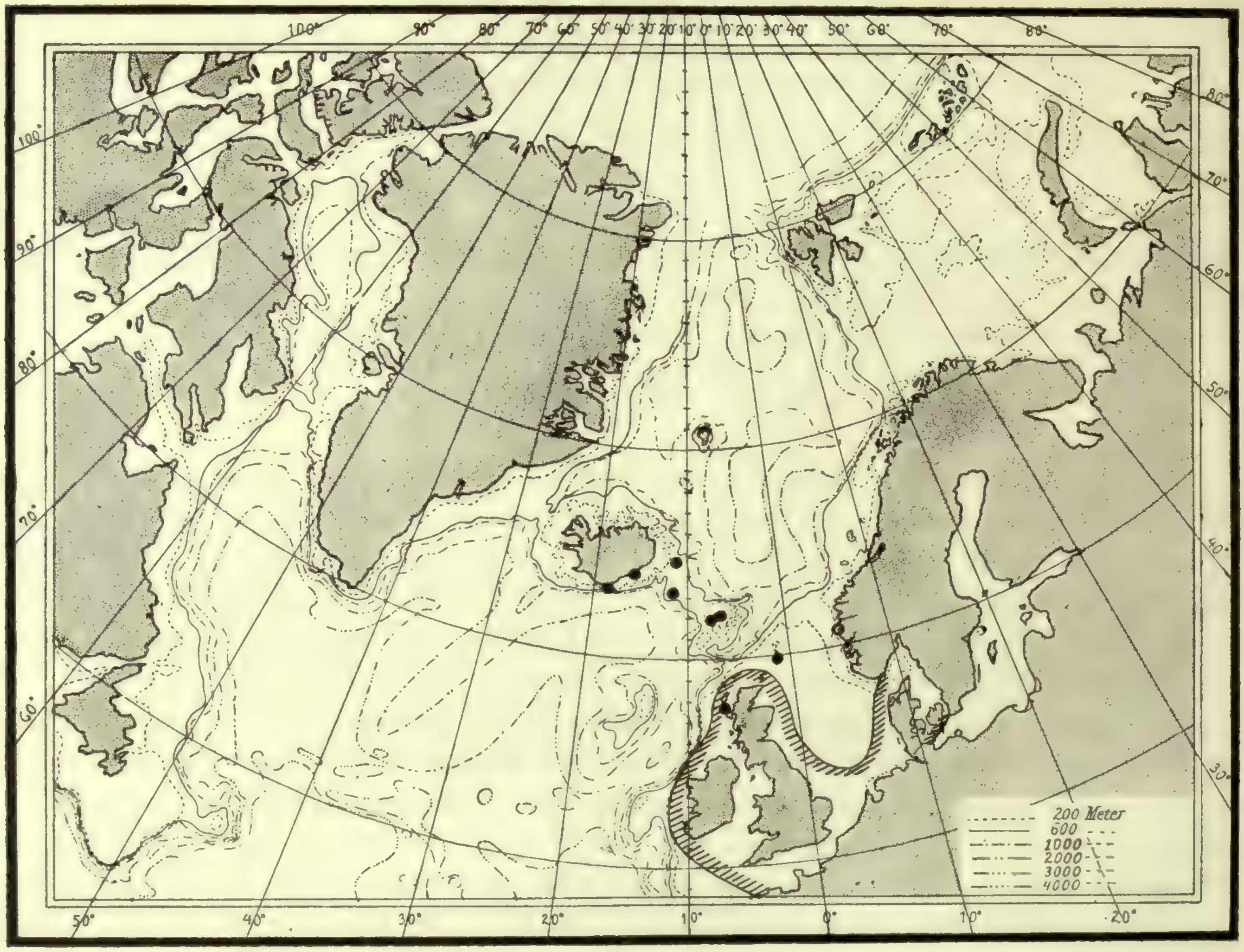

Chart XI. Occurrence of *Phialidium hemisphæricum* (Gronov.) in the northern Atlantic and adjacent waters. — From the regions within the hatched line the literature notes a common occurrence.

4) — Lat. 63°12' N., Long. 11°45' W., south-east of Iceland. August 7th 1904. Young-fish trawl, 20 m wire. "Thor". — 7 specimens, 15—20 mm wide.

5) — Lat. 64°35' N., Long. 11°45' W., east of Iceland. August 8th 1904. Depth 348 m. Young-fish trawl, 20 or 70 m wire. "Thor" stat. 241 (04). — 2 specimens, 19 mm wide.

The Faeroe Islands:

6) — Thorshavn. August 18th 1895. "Ingolf". — 6 specimens, 1—10 mm wide (see below).

7) — Lat. 61°47′ N., Long. 7°29′ W., west of the Faeroe Islands. August 15th 1895. "Ingolf". — 2 specimens, one of which is 10 mm wide with 32 tentacles; the gonads (female) are short and thick.

British Isles:

8) — Lat. 59°48′ N., Long. 1°23′ W., south end of the Shetland Islands. July 22nd 1905. Depth 85 m. "Thor" stat. 122 (05). — 2 specimens, one large and one middle-sized.

9) — Lat. 57°36′ N., Long. 7°05′ W., Little Minch, west of Scotland. May 27th 1908. Depth 90 m. Young-fish trawl, 65 m wire. "Thor" stat. 8 (08). — 2 specimens, the largest of which is 10 mm wide with mature female gonads, 3 mm long.

The largest specimens, found by Browne at the British coasts, were 21 mm in diameter and had 39 tentacles. Among the specimens from Iceland here mentioned several appear to be of more considerable size (up to 25 mm) and, particularly, to possess a larger number of tentacles (up to 58). In all other regards the specimens agree completely with the British *Phialidium hemisphæricum*, so that I do not hesitate to refer them to the same species. It seems quite natural that this species might be found off the southern coasts of Iceland, where the hydroid *Campanularia johnstoni*[1] is fairly common (according to Sæmundsson 1911 and Broch 1918).

The fully expanded tentacles are 2—3 times as long as the diameter of the bell (according to my observations from Plymouth). The tentacular bulbs are fairly broad, spherical, owing to the high development of the ectoderm on the lateral sides of the bulb. The ectoderm is likewise fairly highly developed on the adaxial side (Plate V, fig. 3). The lumen of the bulb is actually somewhat laterally compressed. — Plate IV, fig. 14 shows a section through a marginal vesicle of this species. The marginal vesicle is spherical, half-way inserted on the margin of the bell. There is, as a rule, 2 marginal vesicles between every successive pair of tentacles, though in younger specimens there is usually but one; in large specimens there are not seldom 3 marginal vesicles between two successive tentacles.

In specimens from Iceland the number of tentacles may amount to 58 (this number has been found in 3 specimens). Table XI presents a tabular view of the number of tentacles in 29 Icelandic specimens of different sizes. The calculation of the average numbers of tentacles is based on the exact

Table XI. Number of tentacles in specimens of different sizes of *Phialidium hemisphæricum* from Iceland.

Diameter of individuals, mm	Number of tentacles									
	25	26—30	31—35	36—40	41—45	46—50	51—55	56—58	Total	Average
6—10	1	.	3	.	.	.	.	.	4	30
11—15	.	.	1	2	1	1	.	.	5	40
16—20	.	.	.	4	1	2	3	3	13	48
21—25	.	.	.	.	.	4	2	1	7	51
Total...	1	.	4	6	2	7	5	4	29 specimens	

[1] During my stay at Plymouth in 1914 I confirmed the observation of Browne, that *Campanularia johnstoni* is the hydroid corresponding to *Phialidium hemisphæricum*.

figures found by the measurements. — It will be observed that the number of tentacles varies fairly considerably within one and the same group of size; thus in specimens, 16–20 mm wide, there may be 38—58 tentacles.

Each of the radial canals carries only one gonad, completely encircling the canal without leaving a ventral edge free. This will be seen from the textfigures 16 and 17, representing transversal sections of male and female gonads. The section of the female gonad shows that the eggs are first developed in the middle part on both sides, whereas small, immature eggs are still present in the dorsal and ventral parts.

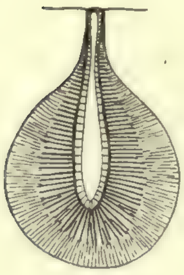

Fig. 16.

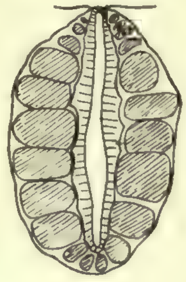

Fig. 17.

Fig. 16. *Phialidium hemisphæricum* (Gronovius). Transversal section through radial canal with mature male gonads. — Fig. 17. *Phialidium hemisphæricum* (Gronovius). Transversal section through radial canal with female gonads.

From the Faeroe Islands we possess a number of young specimens. In the smallest specimens (diameter 1—5 mm) the gonads are spherical and placed near the middle of the radial canals; in a specimen 7 mm wide the gonads (female) are oval, about $1^1/_4$ mm long; in the largest specimen (diam. 10 mm) they are elongate, 2 mm long.

In all specimens from Iceland the gonads are linear. Their length in relation to the length of the radial canals varies from $^1/_3$ to nearly $^3/_4$, but stands in correlation to the developmental stage of the individual, as will be seen from table XII. This table represents the correlation between the diameter of the individuals and the relative length of the gonads (i. e. the relation between the length of the gonads and that of the radial canals, expressed by means of the figure $\frac{g}{r}$). For each individual I have calculated $\frac{g}{r}$ with 2 decimals, and these figures have been used for the calculation of the average numbers presented in the table. In the specimens examined the figure $\frac{g}{r}$ varies from 0.33 to 0.73. It will be seen from the table that up to a size of 6—10 mm in diameter the gonads have nearly the same relative length in both sexes ($\frac{g}{r}$ = about 0.4), but during the

Table XII. Relative length of gonads in specimens of different sizes of *Phialidium hemisphæricum* from Iceland.

Diameter of individuals, mm	$\frac{g}{r}$ relation between length of gonads and length of radial canals						
	0.3	0.4	0.5	0.6	0.7	Total	Average
♂							
6—10	1	1	.	.	.	2	0.39
11—15	.	1	3	1	.	5	0.50
16—20	.	.	1	5	.	6	0.59
21—25	.	.	.	2	2	4	0.67
Total...	1	2	4	8	2	17 specimens	
♀							
6—10	.	3	.	.	.	3	0.42
11—15	.	1	1	.	.	2	0.45
16—20	.	2	4	1	.	7	0.49
21—25	.	.	1	2	.	3	0.53
Total...	.	6	6	3	.	15 specimens	

further development there is a well marked difference between the sexes, the gonads being distinctly longer in the males than in females of corresponding sizes. The difference is so obvious that it can hardly be due to casuality. We may state, in short, that in full-grown specimens the male gonads are about $^2/_3\, r$, the female gonads about $^1/_2\, r$. — In large specimens the gonads, particularly the male gonads, are more or less sinuous.

Occurrence: The medusa *Phialidium hemisphæricum* is very abundant round the British coasts, in the North Sea, and in the Danish waters to the western part of the Baltic. Within this region it is found throughout the year. Young specimens are found in the spring and summer; during the summer we also find half-grown specimens; during the autumn and far into the winter we find large, full-grown specimens. The medusa has also been found at the coast of Norway in the neighbourhood of Bergen. Among the material, here dealt with, there are a number of small specimens from the Faeroe Islands, found in August, and numerous large individuals from the south coast of Iceland from July and August. — If Mayer (1910) is right that the "*Clytia flavidula*" of Metschnikoff is identical with *Phialidium hemisphæricum*, we will have to add the Mediterranean to the known area of distribution of the species.

Phialidium islandicum nov. spec.

Plate IV, figs. 11, 12, 13; Plate V, figs. 1 and 2.

Diagnosis: *Phialidium* of large size, with elongated gonads, with numerous tentacles and an equal number of marginal vesicles.

Description: Umbrella is watchglass-shaped, about 35—40 mm in diameter, gelatinous substance comparatively thin, exumbrella evenly rounded from the apex towards the margin. The stomach is cross-shaped, very small, its perradial diameter being only about one-tenth the diameter of the bell. There is a short mouth-tube provided with four pointed, crenulated lips (Plate IV, fig. 12). Four radial canals, straight and narrow, and a narrow, simple circular vessel. The gonads are developed on the radial canals, completely encircling the canal from both sides of its line of attachment to the subumbrella without leaving a ventral line free of gonads. The gonads are very much elongated, linear, usually not sinuous (Plate IV, fig. 11), commencing about 2 mm from the base of the manubrium, terminating about 1 mm from the circular vessel. The number of tentacles amounts to about 200; their basal bulbs are swollen (Plate V, fig. 1), particularly owing to the ectoderm of the lateral sides being highly developed; there is a slight trace of an abaxial process at the base of the tentacles. There are no cirri. Small, closed marginal vesicles (Plate IV, fig. 13) are present in the same number as the tentacles. Velum is fairly broad but thin and weak. — Hydroid generation unknown.

The number of species of *Phialidium* hitherto described is very large, and several of the species are very much like each other. It might be considered as rather a risky undertaking, therefore, to add a new species to the number already described, but as far as I am aware, there has never been found a *Phialidium* of such considerable size and with a similarly great number of tentacles as that found in the present species. It was pointed out in the preceding pages that *Phialidium hemisphæricum* may attain a larger size and a larger number of tentacles in the waters near Iceland than in the more southerly parts of its area of distribution. It is possible, accordingly, that the species just described will prove in time to be only a northern giant variety of a species already known to science; but as long as it cannot be referred with certainty to any known species, I prefer to describe it as an independent species, for which I propose the name of *Phialidium islandicum*, because all the specimens in hand have been found in the neighbourhood of Iceland.

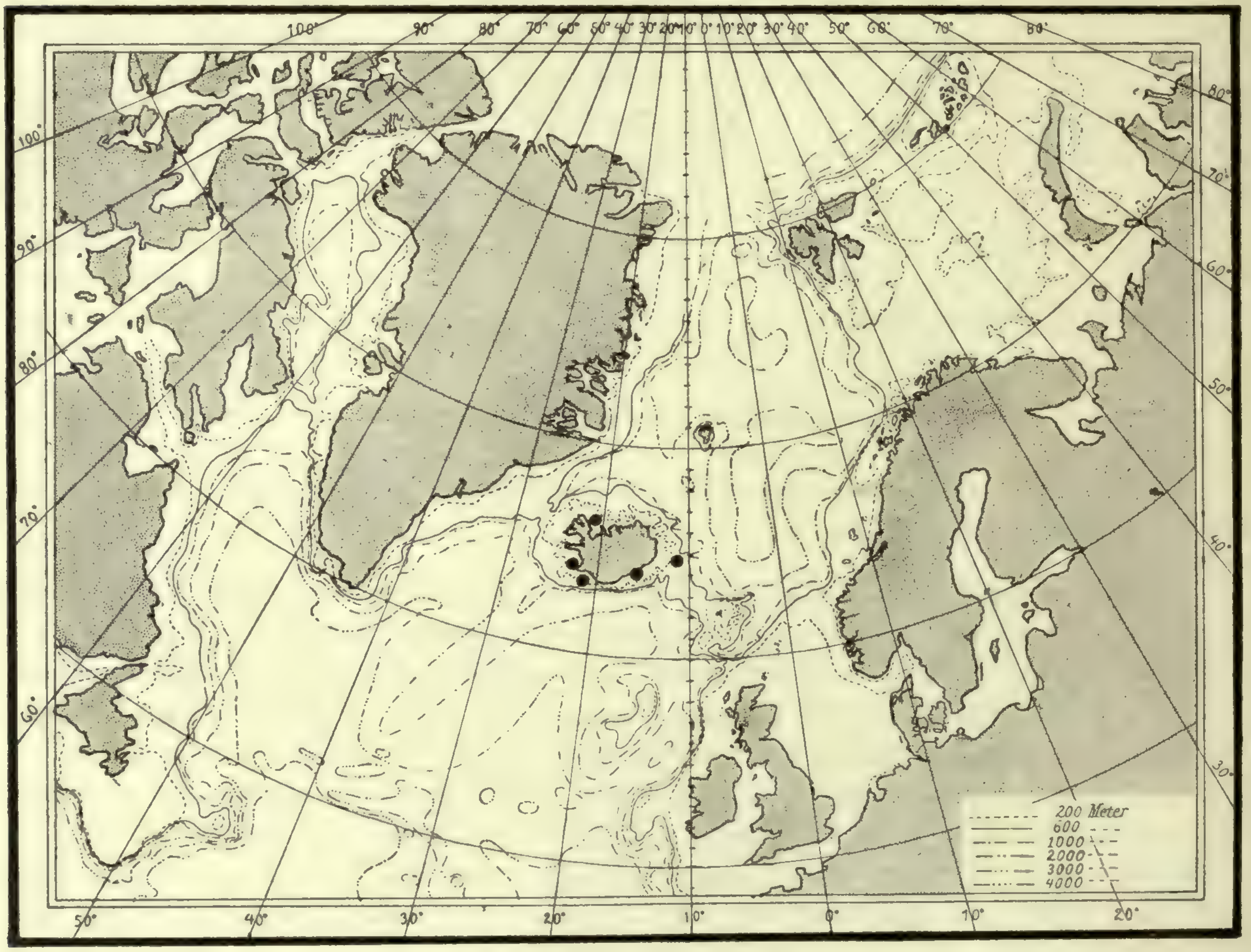

Chart XII. Finds of *Phialidium islandicum* nov. sp.

The species is quite distinct from *Phialidium hemisphæricum*, not only by its size and the large number of tentacles, but also by the number of marginal vesicles never exceeding the number of tentacles. Furthermore the mouth-lips are larger and more crenulated than in the case of *Phialidium hemisphæricum*, and the gonads are longer. The sagittal sections through the tentacular bulbs show (Plate V, figs. 2 and 3) that the ectoderm on the adaxial side of the bulb is more highly developed in *Phialidium hemisphæricum* than in *Ph. islandicum*. The trace of an abaxial process on the base of the tentacular bulbs in *Phialidium islandicum* is not always distinct; in *Ph. hemisphæricum* it is entirely lacking. The shape of the marginal vesicles (see the sections, Plate IV, figs. 13 and 14) presents no particular difference; unfortunately the state of preservation does not allow a determination of the number of concretions in the marginal vesicles.

Material (see Chart XII):

1) — Myri Bugt, south coast of Iceland. July 27th 1904. "Beskytteren", Gemzøe. — 2 specimens, 37—38 mm wide.

2) — Lat. 63°18′ N., Long. 21°30′ W., South-Iceland. July 8th 1904. Depth 178 m. "Thor" stat. 176 (04). — 3 specimens, 22—28—35 mm wide.

3) — Lat. 64°06′ N., Long. 23°14′ W., Faxebugt. July 2nd 1908. Depth 98 m. Young-fish trawl, 65 m wire. "Thor" stat. 45 (08). — 1 specimen, 21 mm wide.

4) — Lat. 66°23′ N., Long. 21°21′ W., North-Iceland. August 24th 1904. Depth 108 m. Young-fish trawl, 70 m wire. "Thor" stat. 266 (04). — 1 specimen, 32 mm wide.

5) — Lat. 64°35′ N., Long. 11°45′ W., east of Iceland. August 8th 1904. Depth 348 m. "Thor" stat. 241 (04). — 2 large specimens, about 40 mm wide.

Table XIII. Diameter, number of tentacles, and length of gonads in *Phialidium islandicum* from Iceland.

Number of locality	Diameter of individuals mm	Number of tentacles	Length of gonads mm	Sex
3	21	152	..	♂
2	28	abt. 175	10	♀
4	32	abt. 200	11	♂
2	35	abt. 185	11—12	♀
1	37	abt. 200	15	♂
1	38	200	15	♀

The specimens from loc. No. 5 are very large, about 40 mm wide; both specimens have lost the gastro-genital organs, but these are regenerating; in one specimen three new stomachs are developing; a nematode is enclosed in the gelatinous substance near the three stomachs.

As will appear from the above list of the material, this species has been found both south, west, north, and east of Iceland; it is probable, therefore, that it is derived from a hydroid widely distributed at the coasts of Iceland (possibly *Campanularia volubilis*?). The specimens have all been found in July or August.

Genus **Eucheilota** Mc Crady.

Eucheilota maculata Hartlaub.

Mayer 1910, Medusæ of the World, p. 285.

Bell somewhat flatter than a hemisphere, about 13 mm vide. Gelatinous substance thick above, but thin at the sides of the bell. Stomach short, with 4 well-developed lips. 4 linear gonads along the outer two-thirds of the 4 radial canals, not touching the circular vessel. 16—30 long tentacles with well-developed, tapering basal bulbs, flanked by cirri. Cirri also arise from the bell-margin between the tentacles. Marginal vesicles, each containing 5—10 concretions, alternating with the tentacles. Gonads and tentacular bulbs light reddish-brown; on each interradial wall of the stomach there is a large black spot.

The species occurs in the North-Sea, whence it is occasionally carried into the Kattegat.

Genus Eutonina Hartlaub.

Eutonina indicans Hartlaub.

Tiarops indicans Romanes 1876 b. New Species, Varieties, and Monstrous Forms of Medusæ. — Journ. Linn. Soc. London. Zool. Vol. XII. — p. 525.

Tiaropsis — Romanes 1877, ibid. — Plate XV, fig. 1.

Thaumantias sp. McIntosh 1888. Seventh Annual Report of the Fishery Board of Scotland. — p. 282, Pl. 5, figs. 6—9.

— - McIntosh 1890. Ann. Mag. Nat. Hist., Ser. 6. Vol. V. — p. 300.

Eutimalphes indicans Haeckel 1879. System der Medusen. — p. 195.

— — Hartlaub 1894. Die Coelenteraten Helgolands. — Wissensch. Meeresuntersuch. N. F., Bd. I. — p. 194.

Eutonina — Hartlaub 1897. Die Hydromedusen Helgolands. — ibid. Bd. II. — p. 507.

— *socialis* Hartlaub. Ibid. — p. 506. Taf. XXII, Fig. 1, 3, 4, 6, 7; Taf. XX, Fig. 19, 20.

Eutimium — Mayer 1910. Medusæ of the World. — p. 306.

Eutonina indicans Bigelow 1913. Medusae and Siphonophorae collected by the "Albatross" in the northwestern Pacific 1906. — Proceed. U. S. Nat. Mus. Vol. 44. — p. 34.

Umbrella somewhat flatter than a hemisphere, 25—30 mm wide; gelatinous substance rather thick. Stomach small, cross-shaped, mounted upon a spindle-shaped peduncle reaching to the level of the bell opening; there are four crenulated lips. 4 radial canals. Gonads linear, wavy, developed upon the lateral sides of the radial canals, leaving a narrow median line on the ventral side free of gonads; the gonads commence at a short distance from the base of the stomachal peduncle and do not quite reach the circular vessel. There are about 200 short tentacles with conical basal bulbs; no cirri; 8 adradial marginal vesicles, each containing about 12 concretions. The velum is narrow.

Like Bigelow (1913) I prefer the generic name *Eutonina* Hartlaub for this medusa. Bigelow writes as follows: "Mayer uses the name *Eutimium* Haeckel for this group (he, however, does not include the number of tentacles as a generic character), but the type species of that genus, *E. elephas* Haeckel, was beyond question a *Eutima*. I formerly used the name *Eutimalphes*; but *Eutonina* seems to have the better claim, because its type species is well known, while that of *Eutimalphes*, *E. pretiosa* Haeckel, was founded for a fragmentary specimen which may have been a *Tima*. It has never been seen since first recorded".

With regard to the question of the specific name, it seems to me that Romanes' description of "*Tiarops indicans*" agrees so well with Hartlaub's description of "*Eutonina socialis*", that there is every probability that they are identical. The high shape of the bell in Romanes' medusa really presents the only noticeable difference and may, as is rightly remarked by Bigelow, very likely be due to contraction. Haeckel's characterisation of "*Eutimalphes indicans*" is a quotation of Romanes. The figure of "*Thaumantias sp.*" given by McIntosh is not to be mistaken.

I. P. van Beneden (1867, p. 87, Pl. III, figs. 1—6) describes and figures a medusa, "*Geryonopsis Forbesii*", which is probably identical with *Eutonina indicans*; true, the gonads are most like those of a *Tima*, but there are too many tentacles for a *Tima*, and the size and shape remind one very much of *Eutonina*. Bedot in his Histoire des Hydroïdes includes "*Geryonopsis Forbesii*" among the synonyms of *Irene viridula* Pér. & Les. Peach (1868, p. 97) mentions a medusa, "*Tima Forbesii*", which is said to be distinguished from *Tima bairdii* by the possesion of numerous tentacles; probably also this medusa belongs to *Eutonina indicans*. The same may be the case with a medusa mentioned by Crawford (1891, p. 296): "A form evidently allied to *Tima*, but with shorter peduncle, with more numerous tentacles, and with the reproductive organs only on a portion of the canals ...".

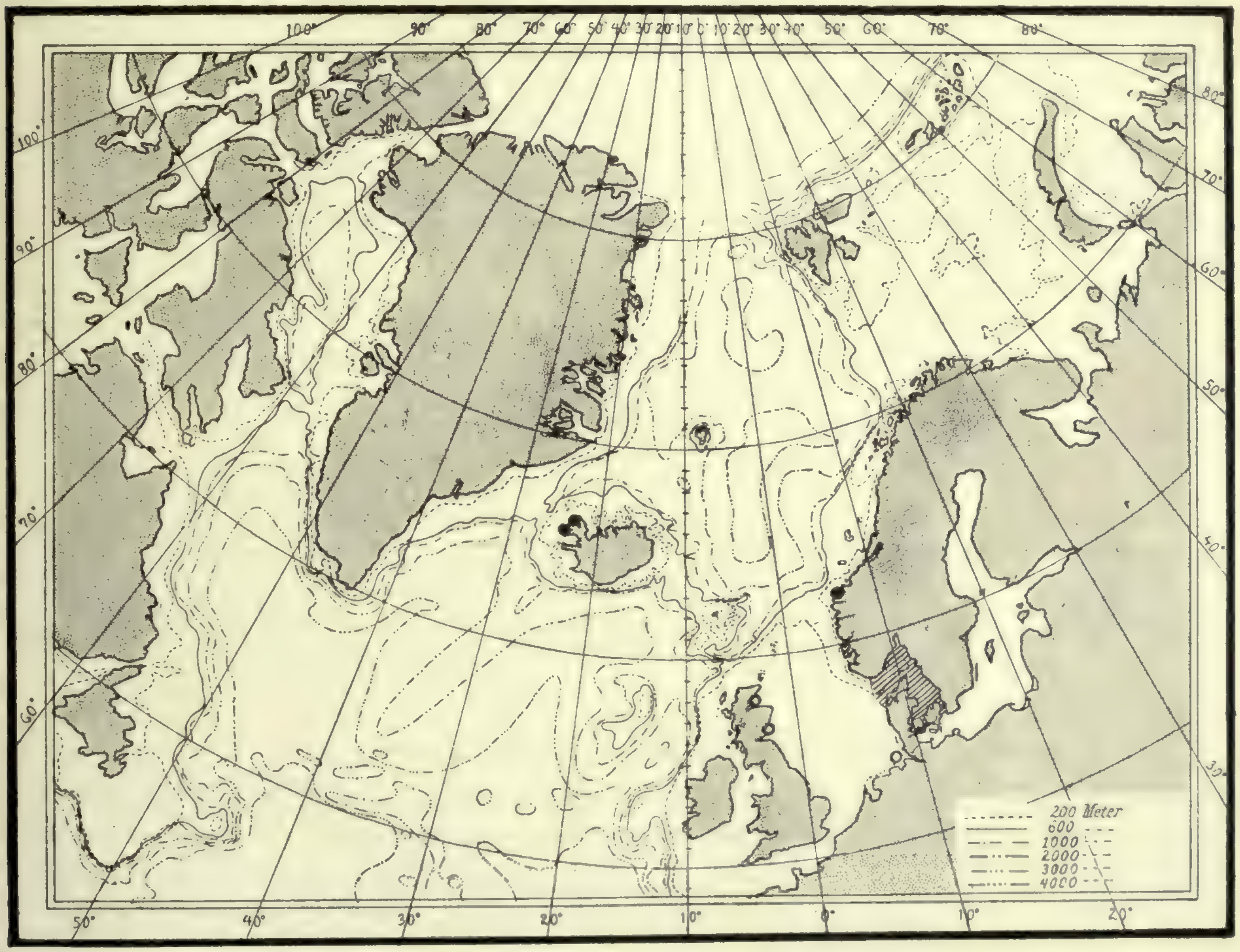

Chart XIII. Occurrence of *Eutonina indicans* in the Atlantic. ○ Occurrence according to the literature. In the hatched region the species has a common occurrence.

Material (see Chart XIII):

1) — Isafjord, north-western part of Iceland. Mariboe 1865. — 1 specimen, 22 mm wide. Identified by Haeckel as "*Eirene* (*viridula Esch.?*)".

2) — Patreksfjord, north-western part of Iceland. June 22nd—23rd 1904. Fished from the ship. "Thor" stat. 159 (04). — 2 specimens, 12, 14, and 17 mm wide.

3) — Borgundfjord, near Aalesund, Norway. June 25th 1902. "Michael Sars", Ad. S. Jensen. — 19 specimens, about 16—27 mm wide.

Moreover the Zoological Museum of Copenhagen possesses a large number of specimens from Danish waters, where this species is exceedingly abundant right into the Belt-Sea.

It is very interesting that Bigelow has found this North-European species in the northern Pacific. Bigelow states that "the only noticeable separation between examples from the two localities is that in those from the Bering Sea the gonads begin close to the base of the peduncle, instead of at a slight distance from it, as in the Helgoland specimens, but the difference is so slight that it is probably a developmental feature". I have paid attention to this statement, and I have found that the authors last-mentioned supposition does not hold good; as a matter of fact, in young as well as full-grown individuals there is always some distance from the stomachal peduncle to the proximal end of the gonads (see Table XIV).

Table XIV. Dimensions of specimens of *Eutonia indicans* from the abovementioned localities.

Number of locality	Diameter of individuals mm	Number of tentacles	Length of gonads mm	Distance from		Sex	Remarks
				gonads to stomachal peduncle mm	gonads to circular vessel mm		
2	12	171	4½	1¼	1	♂	somewhat contracted
—	14	abt. 185	...	1¼	1	♀	
—	17	169	...	1½	1	♀	
1	19	175	4	2¼	1¼	♀	immature
3	22	...	7—8	1½	1	♀	somewhat contracted
1	25	206	6½	2¼	1¼	♀	mature
—	26	abt. 196	7	3¼—3½	1	♂	—
—	26	188	6	3[illegible]	1½	♀	hardly mature
—	27	204	8	2¾	1	♂	mature
—	27	213	6½	3	1	♂	—

Measurements on Danish specimens have given corresponding results with regard to the distance from the base of the stomachal peduncle to the proximal end of the gonads; thus there actually seems to exist a characteristic difference in this respect between the specimens from Europe and those from the Bering Sea; but as they agree exactly in all other respects, this slight difference hardly justifies a separation of the two forms as distinct species, unless the corresponding hydroids should prove to be specifically different.

Hartlaub gives the number of tentacles as about 150, but, as will appear from the figures in table XIV, the number may amount to about 200.

Eutonina indicans has up to now been found on the following localities in the Atlantic area: east coast of Scotland: Cromarty Firth (Romanes) and St. Andrews Bay (McIntosh); Heligoland (Hartlaub); and, if "*Geryonopsis Forbesii*" van. Beneden is identical with the present species, also off the coast of Belgium. It is mentioned in the International Plankton-lists as occurring in the Skagerrak. In Johansen and Levinsen: De danske Farvandes Plankton (1903), it has been confounded with *Tiaropsis multicirrata*.

The present material augments the known area of distribution to comprise the west coast of Norway at Aalesund and the fjords on the north-western part of Iceland.

The Norwegian specimens as well as those from Patreksfjord in Iceland are found in the later half-part of June. The species is said to occur off the east coast of Scotland from May to August. It occurs at Heligoland from the end of March to the beginning of July and may be carried into the beach in enormous quantities. It is found in the Danish waters from the beginning of April to the end of June. In May 1916 I saw enormous quantities at the surface of the water in Lillebelt.

Genus **Saphenia** Eschscholtz.

Saphenia gracilis (Forbes and Goodsir).

Mayer 1910, Medusæ of the World, p. 294.

Syn. *Saphenia mirabilis* (Wright) Haeckel.

Bell hemispherical, about 15—20 mm wide. There is a long and thin, cylindrical gelatinous peduncle which may be extended to a length of 5–10 times the diameter of the bell. The peduncle is entirely surrounded by the four linear gonads, which extends from the base of the peduncle to the stomach; the latter is small, flask-shaped, with 4 small, recurved lips. Two long, opposite tentacles and a large number of marginal warts and cirri. 8 adradial marginal vesicles, each containing about 3 concretions. Stomach and gonads delicately pink.

British coasts and North Sea.

Genus **Eutima** Mc Crady.

Eutima insignis (Keferstein).

Mayer 1910, Medusæ of the World, p. 299.

Umbrella hemispherical, about 8 mm wide. The stomachal peduncle is once or twice as long as the diameter of the bell, narrow, of equal width. Stomach about half as long as the bell-radius, flask-shaped, with 4 large lips. The gonads extend from near the stomach upwards along the 4 radial canals on the peduncle; there are no gonads on the subumbrella. There are 4 long perradial tentacles, each flanked by a pair of cirri; moreover there are about 30 rudimentary bulbs, likewise flanked by cirri. 8 adradial marginal vesicles, each containing 2—5 concretions. The animal is colourless.

British coasts and north-west coast of France.

Eutima elephas (Haeckel).

Mayer 1910, Medusæ of the World, p. 300.

Umbrella about 16–20 mm wide; gelatinous substance thick. The upper part of the stomachal peduncle is broadly conical; the entire length of the peduncle is about 3 to 4 times the diameter of the bell. Stomach short, urn-shaped, with 4 recurved, slightly folded lips. 4 radial canals; the gonads are developed along the radial canals on the narrow part of the peduncle. There are 4 long perradial tentacles and numerous minute warts on the bell-margin; no cirri; 8 adradial marginal vesicles, each containing about 8—10 concretions. Stomach, canal system, and tentacles green.

North Sea.

Genus **Octorchis** Haeckel.

Octorchis gegenbauri (Haeckel).

Syn. *Eutima campanulata* (Claus). Mayer 1910, Medusæ of the World, p. 302.

Umbrella hemispherical, about 25—30 mm wide. Stomachal peduncle about as long as the bell-diameter, the upper part broadly conical. Stomach small, urn-shaped, with 4 folded lips. 4 radial canals; the gonads are developed partly along the subumbrella part of the radial canals, partly on the peduncle about half-way between the base of the peduncle and the stomach. There are 16—32 long tentacles and about 120—150 tubercles, flanked by cirri. 8 adradial marginal vesicles, each containing 16–20 concretions. Stomach, canal-system, gonads, and tentacles greenish.

North Sea, Atlantic coasts of Great Britain and France, Mediterranean, Canary Islands.

Genus Eirene Eschscholtz.

Eirene viridula (Péron et Lesueur).

Mayer 1910, Medusæ of the World, p. 311.

Umbrella very flat, about 6—15 mm wide; gelatinous substance thin. Stomachal peduncle half as long as bell-radius, pyramidal, slender. Stomach small, with 4 long, crenulated lips. 4 radial canals, very narrow. Gonads linear, somewhat sinuous, developed along the subumbrella parts of the radial canals. 50—60 short tentacles and about 100 even smaller tentacles; each of the latter is flanked by a pair of cirri; each of the tentacular bulbs bears an abaxial excretion papilla. There are about 100 small marginal vesicles, each containing 2—4 concretions. Velum very narrow. Stomach, gonads, and tentacles milky-white, green or reddish.

Atlantic coasts of Europe, Mediterranean.

Genus Tima Eschscholz.

Tima bairdii (Johnston) Forbes.

Plate V, figs. 4, 5, 6, 7, 8, 9, 10.

Dianæa Bairdii Johnston 1833. Illustrations in British Zoology. Art. IV. — Mag. Nat. Hist. Vol. 6. — p. 320, fig. 41.

— — Thompson 1844. Report on the Fauna of Ireland, Invertebrata. — Rep. 13th Meeting, Brit. Assoc. — p. 282.

Tima? — Forbes 1846. On the Pulmograde Medusæ of the British Seas. — Ann. Mag. Nat. Hist. Vol. 18. — p. 286.

Medusa (*Tima* Eschsch.) Dalyell 1847—48. Rare and remarkable Animals of Scotland. Vol. 2. — p. 250; Pl. 52, fig. 5.

Tima Bairdii Forbes 1848. British Naked-eyed Medusæ. — p. 37; Pl. 5, fig. 1.

— — Allman 1871. Monograph of the Gymnoblastic or Tubularian Hydroids. — pp. 36, 140, figs. 11, 12.

— — Böhm 1878. Helgolander Leptomedusen. — Jenaische Zeitschr. Bd. XII (N. F. Vol. I). — pp. 143, 145.

— — Haeckel 1879. System der Medusen. — p. 205.

Description:

Umbrella hemispherical or somewhat higher than a hemisphere, about 60 mm wide when fully developed. Gelatinous substance very thick. The stomachal peduncle is nearly conical; it is highly contractile; its length as well as the width of its base are, accordingly, very much variable, and measurements of preserved material are, therefore, of no great value; but the approximate dimensions may be stated as follows: The diameter of the base of the peduncle varies between about $^1/_2$ and $^2/_5$ of the diameter of the bell; the length is, when expanded, about equal to the bell-diameter, the peduncle extending more or less beyond the level of the bell-margin.

The stomach (Plate V, fig. 5) is small, square, fixed to the flattened terminal end of the peduncle by a cross-shaped figure; thus there are four flat, triangular pouches between the dorsal wall of the stomach and the terminal end of the peduncle. In some cases, i. e. in certain conditions of contraction, the entire stomach is cross-shaped in transverse section. The four perradial lines of attachment (the cross-arms) are seen, from the stomachal cavity, as deep, narrow grooves (Plate V, fig. 4). From the distal ends of these four grooves issue the four radial canals which, from these points, run upwards along the peduncle (Plate V, fig. 5). The openings of the radial canals may be completely closed by contraction of the borders of the grooves, thus the lumen of the canals being separated from the cavity of the stomach; in the stomach figured in Plate V, fig. 4, the openings on the left side have been closed in that manner.

The basal part of each radial canal is a little widened and has a number of fine, transverse folds.

The mouth-opening is wide and is provided with four large, pointed lips, complexly folded and with a crenulated margin (Plate V, fig. 5).

There are four straight radial canals and a very narrow circular vessel. The mode of attachment of the radial canals to the subumbrella (and the stomachal peduncle) is remarkable (see Plate V, fig. 10). The usual median streak of high entodermal cells is very narrow, but the uppermost parts of the lateral entodermal layer of the canal on both sides are attached to the subumbrella, the ectoderm and the mesosarc leaving the subumbrella at some distance from the median streak; thus the line of attachment has secondarily become rather broad.

The gonads are developed upon both sides of the radial canals from the attachment to the subumbrella, leaving a narrow median line free on the ventral edge. Though the line of attachment to the subumbrella is straight, the lateral walls of the canals are, in the parts carrying the gonads, very much folded in a fairly regular, wavy manner. The gonads extend partly over the subumbrella from the base of the peduncle towards the bell-margin, reaching nearly to the circular vessel, partly downwards along the peduncle, ceasing at a distance of some few millimeters above the stomach. The gonads attain their highest development and are most highly folded upon the subumbrella, gradually tapering during their course downwards upon the peduncle. Sections laid through different parts of the gonads of one and the same specimen show, however, that the sexual products are in the same state of maturity in every part. In the highly folded parts the ventral median line, free of gonads, is sometimes fairly broad, sometimes very narrow, shaped like a deep furrow, and is, in such cases, hardly visible, except in sections.

The usual number of tentacles is 16. When fully expanded, the length of the tentacles is about 3 times the diameter of the bell. The tentacular bulbs (Plate V, figs. 6, 7, 8) are oblong, pear-shaped, gradually passing into the thread-like part of the tentacles. The ectoderm of the bulb is somewhat thickened, equally developed all round the bulb (Plate V, fig. 8). Proximally the abaxial side of the bulb is sharply set off from the exumbrella. There is a well-developed, hollow, entodermal basal spur projecting into the gelatinous substance of the exumbrella, curving outwards and upwards, its abaxial side resting close to the exumbrellular epithelium, which is slightly thickened in this part (Plate V, fig. 8). Above each of the tentacles there is a slight, rounded prominence of the exumbrella (Plate V, figs. 6 and 7); this may be due to contraction owing to the preservation. The points of insertion of the tentacles are usually not quite equidistant.

Between the tentacles there is a large number of marginal warts (see Plate V, fig. 6). The base of the warts is rectangular, the warts being placed closely together. In some cases they are separated from each other by a sharp furrow, but sometimes they pass gradually into one another; it is difficult, therefore, to state their exact number; in well-grown specimens there may be about 200—250 warts. The ectoderm of the warts is somewhat thickened (Plate V, fig. 9). On the abaxial side of some of the warts may be found a small tenon, a rudimentary tentacle.

The marginal vesicles are very numerous, about half as numerous as the warts; they are situated, with a broad base, in the middle of the adaxial side of the warts, close to the velum (Plate V, fig. 9).[1]) Marginal vesicles are never found on warts provided with tentacular rudiment. As all of the material at my disposal has been preserved in formalin and left there for several years, the concretions of the marginal vesicles have been dissolved; according to Allman (1871) the number of concretions in each marginal vesicle varies from 4 to 20 in one and the same specimen.

The velum is well-developed and as broad as the length of the tentacular bulbs.

In living specimens the tentacles are said to be light pink.

Though this medusa is very common in the North Sea and adjacent waters, no description has been given since 1848 (Forbes). It was first discovered by G. Johnston (1833) who made a short description and a somewhat rough figure of the species. A very fine drawing was given by Dalyell (1847—48). The description delivered by Forbes (1848) was rather incomplete. A few morphological remarks are found in the works of Allman (1871) and Böhm (1878). The description in Haeckel's monograph (1879) is based on the descriptions and drawings of Dalyell and Forbes. — The records on the occurrence of the species are likewise rather few. It is no wonder, therefore, that Mayer (1910, p. 319) has an entirely incorrect interpretation of the relationship and distribution of the species. Mayer suggests that *Tima bairdii* may prove to be the young of *Tima formosa* which is found off the Atlantic coasts of New England, and that it is an arctic form occasionally appearing at the coasts of Scotland.

Tima formosa L. Agassiz reaches twice the size of *Tima bairdii* and has about 32 tentacles of three different sizes; according to Bigelow (1913, p. 36) the number of tentacles may amount to 39; it has about 100 marginal warts, whereas *Tima bairdii*, though it is a smaller species, may have more than 200. Mayer (1910, p. 317) and Bigelow (1913, p. 36) confirm the statement of A. Agassiz, that the marginal vesicles in *Tima formosa* alternate with the warts, being placed in the spaces between the latter; in *Tima bairdii* they are placed on the warts themselves (see above). The two species may be nearly related to one another, but they are clearly distinct species.

More peculiar is the suggestion of Mayer (1910, p. 319), that *Tima flavilabris* Eschscholtz might be the young of *Tima formosa*. It is not very likely that a large species with about 80 short tentacles might be a young stage of a smaller medusa with only 32 tentacles. *Tima flavilabris* Eschscholtz from the Azores is, without any doubt, identical with *Tima lucullana* Delle Chiaje from the Mediterranean, *flavilabris* being the correct name of the species[2].

Besides the species already mentioned, we know another Atlantic species of *Tima*, viz. *Tima teuscheri* Haeckel from the coast of Brazil, possessing 8 long and 40 short tentacles.

[1]) A. Agassiz in his description of *Tima formosa* states that the marginal vesicles are situated in the spaces between the warts.

[2]) The question of the correct name of this species will be discussed in a later work.

In the Pacific the genus is represented by *Tima saghalinensis* Bigelow (1913, p. 35), a large species, distinguished by its very short peduncle and by the lips being extraordinarily complexly folded.

Material:

I have had at my disposal for investigation numerous specimens from Danish waters, but only 4 specimens from one locality outside the Danish area:

Lat. 55°10′ N., Long. 1°55′ E. May 3rd 1905. Depth 33 m. Young-fish trawl. "Thor" stat. 14 (05). — 4 specimens, diameter: 35, 42, 43, and 58 mm.

The Danish specimens have been found at 23 different localities in the North Sea, the Skagerrak, the Kattegat, and the northern part of the Sound. The species has also been found in the northern part of the Lillebelt.

I am not going to give a thorough account of the Danish finds in this place, but shall restrict myself to make some few remarks on the appearance of a number of young specimens.

Most of the specimens, examined by me, are large and medium-sized, the largest being 58 mm in diameter. But there are also some young specimens, the smallest being 6 mm. The height of a specimen, 6 mm wide, is 4 mm, the gelatinous substance being 2 mm thick apically, and the depth of the bell-cavity being likewise 2 mm. — The peduncle is short in these small specimens. In a specimen, 13 mm wide, the peduncle is 4 mm long, 3 mm wide at the base.

When the diameter is below 13 mm only slight traces of gonads are present, and they are confined to the subumbrella part of the radial canals, ranging from the base of the peduncle very nearly to the circular vessel.

Three of the specimens, which are 6, 7, and 10 mm wide, have 8 tentacles, all alike; 8 adradial swellings just visible indicate the places of the remaining tentacles. In two specimens, 11 and 13 mm wide, one of the adradial tentacles has developed, but is much smaller than the 8 perradial and interradial ones. One specimen, 13 mm wide, possesses 16 tentacles, the perradial and interradial all alike, while the others are much smaller and in different stages of development. I have not seen specimens with less than 8 tentacles, and these have always been of equal size in the same individual. The number of marginal vesicles in these small specimens (6—13 mm) is 29—34. A specimen, 23 mm wide, has about 84 marginal vesicles.

One of the specimens from the above-mentioned locality in the western part of the North Sea is abnormal, in so far as one of the four quadrants is narrower than the others, and there are no tentacles between the two adjacent radial canals. I have observed the same abnormality in no less than 3 of the Danish specimens.

Distribution (see Chart XIV):

This large medusa seems to be strictly confined to the North Sea, the Skagerrak, and the Kattegat. It has been recorded from Berwich Bay (Johnston 1833), May Island (Dalyell 1847—48), Burtisland (Forbes 1848), and St. Andrews Bay (Forbes 1848, Mc Intosh 1890, Crawford 1891); all these localities are at the southern part of the east coast of Scotland. According to Mc Intosh the species abounds all along the eastern shores of Great Britain to the estuary of the Thames (Mc

Intosh 1890, p. 304), but no precise records are given. Hartlaub (1894, p. 196) has found it at Heligoland. Broch (1905, p. 7) records it from the Søndeledfjord on the Norwegian coast of the Skagerrak. In the International Plankton Catalogues (1906 and 1908) it is recorded from various localities in the eastern part of the Skagerrak. Also Aurivillius (1897—98) records it from the Skagerrak. A. C. Johansen and Chr. Levinsen (1903) have mentioned it from the Kattegat. No other records as to the

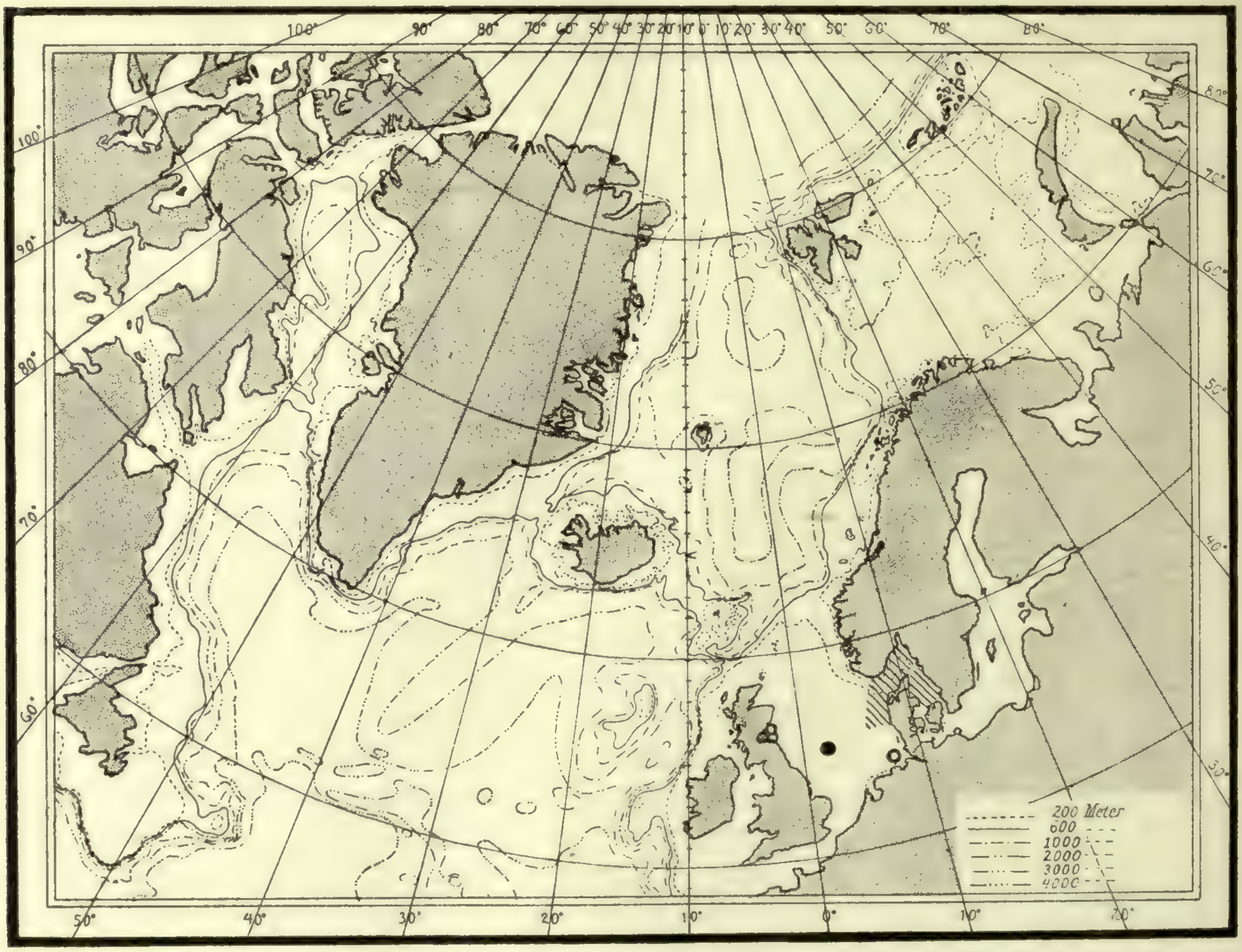

Chart XIV. Occurrence of *Tima bairdii* Fewkes. ○ Occurrence according to the literature. Within the hatched region the species has a common occurrence.

occurrence of *Tima bairdii* are found in the literature. Thus it seems certain that it does not occur north and west of the North Sea. It is very remarkable and interesting that the distribution of one of the largest species among the Leptomedusæ of the North-European waters is entirely restricted to a comparatively small area.

Tima bairdii may be found at different depths. Most frequently it has been found in the upper water layers, but in the Skagerrak it has been found near the bottom at considerable depths, *viz.* 105, 140, 254, and 547 m.

Seasonal occurrence: Off the British coasts large specimens are found during the autumn and winter, apparently not later than the end of January; according to Mc Intosh young specimens have been found in February, May, and August. — In the Danish waters quite young specimens have been found in June and July; large specimens occur during the winter and early spring from November to April, rarely in May.

Family Æquoridæ.

Genus Æquorea Péron et Lesueur.

Æquorea forskålea Péron et Lesueur.

Mayer 1910, Medusæ of the World, p. 325.

Umbrella usually flatter than a hemisphere, up to about 400 mm wide; gelatinous substance thick in the middle part, thin at the margin. Stomach wide, mouth usually widely gaping, with several pointed lips. Numerous simple radial canals (up to about 200), carrying the gonads. Numerous tentacles of varying length. No cirri. Marginal vesicles even more numerous than the tentacles, each containing 2—4 concretions. Colour highly variable.

The species is widely distributed, but the distribution cannot be stated exactly, because we are not yet able to establish the limitations between the different species or variaties of *Æquorea* described. It has been found off the Atlantic coasts of Great Britain and the northern part of Norway.

Genus Zygodactyla Brandt.

Zygodactyla groenlandica (Péron et Lesueur).

Mayer 1910, Medusæ of the World, p. 335.

Umbrella usually flatter than a hemisphere, large; gelatinous substance very thick in the middle part, thin at the margin. Stomach broad, flattened, with a prolonged, cylindrical mouth-tube; the mouth is provided with long, pointed lips, equal in number to the radial canals. About 100 simple radial canals, carrying the gonads; between each successive pair of radial canals the subumbrella carries a row of gelatinous, wart-like protuberances. Tentacles slightly more numerous than the radial canals, long, with tapering bulbs. Between each successive pair of tentacles there are about 8–12 marginal vesicles, each containing 2 concretions. There are no cirri. Velum rudimentary. Colour of gastro-genital system and tentacles very delicately pink.

East coast of North America and west coast of Greenland.

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Errata.

Page 19, line 29 stands: stat. 241 (09), read: stat. 241 (04).
— 46, line 17 stands: sout, read: south.
— 59, text, line 3 stands: (1905), read: (1909).
— 85, text, line 4–5 stands: textfig. 14, read: textfig. 15.

Explanation of the Plates.

List of abbreviations.

ap. j.	apical jelly.
c.	cordylus.
c. v.	circular vessel.
ex.	exumbrella.
g.	gonads.
m. e.	mouth-edge.
m. v.	marginal vesicle.
m. w.	marginal wart.
n.	nematocysts.
r c.	radial canal.
r. s	line of connection between radial canal and subumbrella.
sp.	tentacular spur.
st. d.	dorsal wall of stomach.
st. l.	lateral wall of stomach.
st. p.	stomachal peduncle.
sub.	subumbrella.
t.	tentacle.
v.	velum.

Plate I.

Plate I.

Figures 1—8 *Chromatonema rubrum* (Fewkes).

Figure 1. A specimen from the Davis strait, "Tjalfe" stat. 336. Diameter 17 mm, height 14 mm. — × 5.

— 2. Part of the bell-margin with two tentacles and three cordyli. — "Tjalfe" stat. 336. — × 20.

— 3. Cordylus with nematocysts. — "Tjalfe" stat. 336. — × 65.

— 4. Lateral view of a part of a radial canal with four female gonads. The gonads are faintly discerned through the lateral wall of the radial canal. The subumbrella has been lifted up in front in order to make it possible to peep into the pouches between the subumbrella and the dorsal wall of the radial canal. The eggs are visible, and the fissures leading to the inner, narrow lumen of the gonadial sacks are seen. — × 12.

— 5. Horizontal longitudinal section through the lower part of the gonadial sacks. In most of the gonads the inner lumen with its ectodermal epithelium is seen. Two of the gonads on the left side have been hit so far below, that the lumen has not been touched by the section. — × 24.

— 6. Horizontal longitudinal section through the same radial canal. This section has passed through the upper part of the gonadial sacks, showing the openings of the gonads into the bell cavity. — × 24.

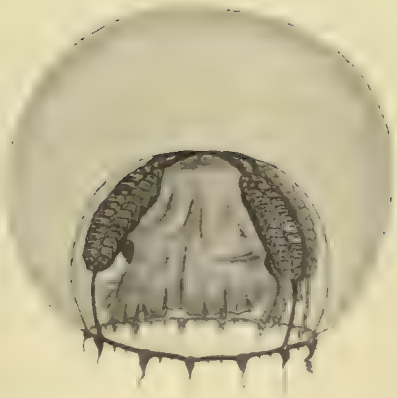
— 7. Transverse section of a radial canal with two female gonads. The gonad to the left has been hit nearly in the middle, exhibiting the entodermal (outer) epithelial cover of the sack, the eggs, and a small part of the ectodermal epithelium of the lumen. On the right side the section has just passed through the entodermal epithelium of the gonad. Above the left gonad is seen the pouch between the dorsal wall of the canal and the subumbrella. On the right side the section has passed through one of the branches of the line of attachment of the canal. — × 25.

— 8. Transverse section through a radial canal with two male gonads. To the left the section has passed nearly through the middle of the gonad, showing the ectodermal lumen, the spermatocytareous and the spermatogonial parts of the testis, and the entodermal epithelium of the sack. On the right side the section has passed mainly through the spermatogonial part of the testis. The ventral part of the canal is wanting. — "Thor" stat. 93 (04). — × 25.

— 9. *Staurophora mertensii* Brandt. — A part of the bell-margin of a specimen from Borgundfjord near Aalesund, Norway. Showing tentacles with entodermal spurs, cordyli, and centripetal furrows in the exumbrella. — × 30.

— 10. *Melicertum octocostatum* (M. Sars). — Radial canal seen from the subumbrella side. A part of the lateral wall of the stomach is seen from the inner side, showing the vertical fissure connecting the radial canal with the stomach cavity. — "Thor" stat. 203 (04). — × 10.

4



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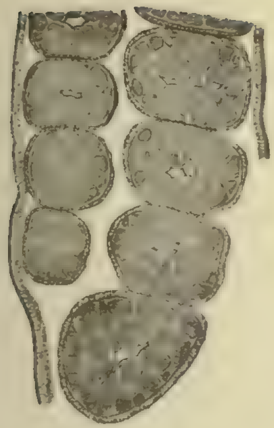

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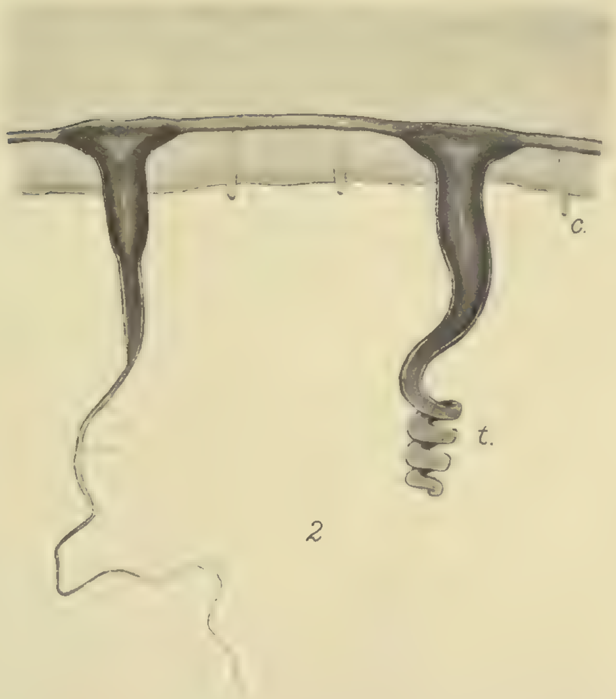

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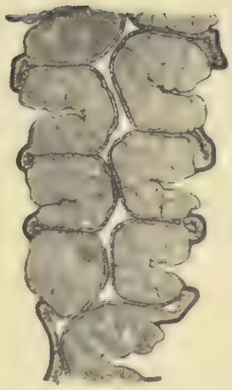

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Plate II.

Plate II.

Figures 1—8 *Laodicea undulata* (Forbes and Goodsir).

Figure 1. A specimen seen from the top. — × 3.

— 2. Radial canal with gonads and a part of the stomach; showing the grooves along which the dorsal wall of the stomach is attached to the subumbrella. The corner of the mouth and the ventral side of the funnel-shaped part of the radial canal have been cut open. The gonads commence at the point, where the open groove becomes closed by means of the two lateral folds, mentioned in the text (p. 17). The dark, wavy line is the narrow, nearly closed fissure between these folds, connecting the space between the gonads with the stomach and the funnel-shaped dilatation. The proximal parts of the gonads are faintly visible through the dorsal wall of the stomach. — From a specimen, about 25 mm in diameter, from Myri Bugt, Iceland, July 21st 1904. — × 6.

— 3 and 4. Transverse sections (made by hand) through the radial canal of a male specimen from "Michael Sars" stat. 140, June 26th 1903. Showing the lateral folds of the walls of the canal containing the sexual products, and, below, the funnel-shaped part of the canal.

— 5 and 6. Radial sections (made by hand) through the bell-margin with tentacles in different stages of development. The tentacle represented in fig. 5 is comparatively young and has a well-developed basal spur. The tentacle in fig. 6 is fully developed the basal part of the abaxial side of the tentacle has grown upwards along the exumbrella and caused the spur to disappear. Observe the ectodermal thichening on the adaxial side, and the course of the central canal.

— 7. Transverse section (microtome-section) through the dorsal wall of the stomach near the corner of the latter, showing male gonads and the two lateral folds. Owing to the preparation these have separated a little from one another, thus not completely separating the space between the gonads from the stomachal cavity. — "Michael Sars" stat. 140 (03). — × 30.

— 8. Part of the bell-margin seen from the abaxial side, with tentacles, cordyli, and a single cirrus (to the left). In two of the tentacles the spur has disappeared. — Myri Bugt, Iceland, July 24th 1904. — × 15.

Figures 9—10 *Staurophora mertensii* Brandt.

Figure 9. Complexly folded gonads seen from above. The gonads have been carefully detached from the subumbrella, showing the branched lines, by which they have been attached. — Myri Bugt, Iceland, August 9th 1904. — × 10.

— 10. Longitudinal section through a tentacular bulb and the circular vessel. The gelatinous substance of the bell-margin is much shrivelled. — "Thor" stat. 45 (08). — × 50.

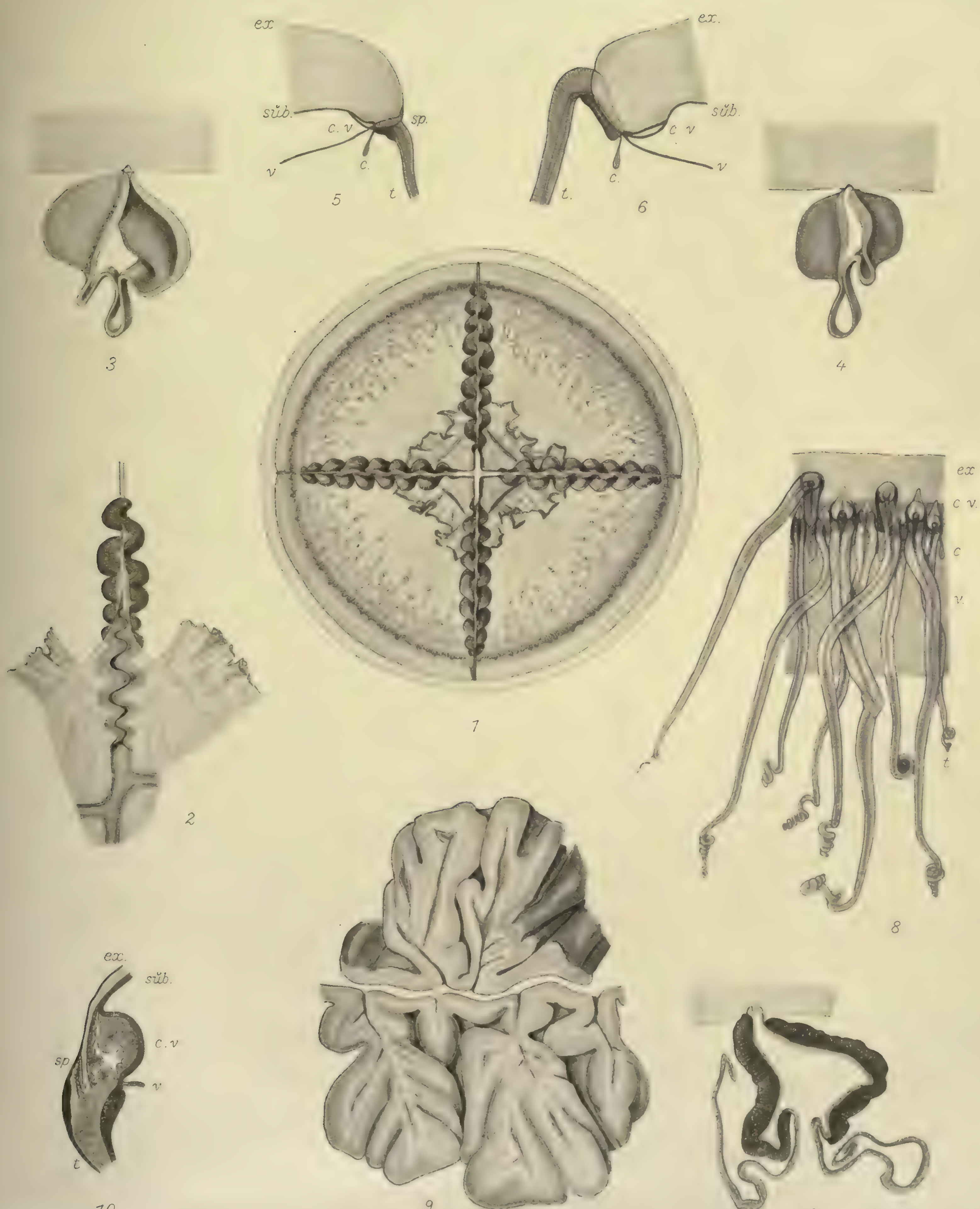

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Plate III.

Plate III.

Figures 1—6 *Ptychogena lactea* A. Agassiz.

Figure 1. Dorsal wall of the stomach seen from the inner side, showing the four grooves, which in this specimen do not meet exactly in the centre. The margins of the grooves are developed into lateral, longitudinal folds, which transform the grooves into closed canals, which open into the stomach near the centre; these openings are seen in the figure. — From a specimen, 90 mm wide, from "Tjalfe" stat. 125. — × 3.

— 2. Transverse section of a radial canal with two lamellæ with their papillæ. The lower part of the figure represents the funnel-shaped, ventral part of the radial canal, separated from the narrow, dorsal part by the two longitudinal folds, which are clearly visible in the figure. — From the same specimen. — × 6.

— 3. Part of the conical part of a radial canal. The ventral wall is partly cut away, so that the longitudinal folds, which separate this part from the narrow, dorsal part, are visible. — From the same specimen. — × 6.

— 4. Longitudinal section through a part of a radial canal, showing the entrances to the lateral pouches, the longitudinal fold, and the lateral wall of the funnel-shaped part of the canal. — From the same specimen. — × 6.

— 5. Transverse section through four of the lamellæ (parallel with the radial canal) with male gonads. In the second lamella from the right the section has passed through the middle of one of the papillæ, demonstrating that the lumen of the latter communicates with the lumen of the lamella. In the first lamella from the right the section has touched one of the papillæ. In the papillæ the entoderm consists of a single layer of cubical cells; in the lamellæ there are several layers of smaller entodermal cells. — Microtome-section. — From the same specimen. — × 20.

— 6. Radial section through the bell-margin, showing a tentacle and a cordylus. On the abaxial side of the base of the tentacle is seen the short conical extension, the rudimentary spur. The cordylus is mounted upon a small tubercle. — From a specimen from Lat. 59°07' N., Long. 13°32' W. One of the type-specimens of *Ptychogena pinnulata* Haeckel. — × 17.

— 7 a—f. *Staurophora mertensii* Brandt. — Examples of cordyli developing into tentacles (see p. 6 in the text). — From a specimen from Iceland, "Thor" stat. 208 (04). — × 20.

— 8. *Melicertum octocostatum* (M. Sars). — Transverse section through a radial canal with female gonads. Showing the broad line of attachment to the subumbrella and the considerable distance from the subumbrella to the upper edge of the gonads. — From a specimen from Iceland, "Thor" stat. 258 (04). — × 50.

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Plate IV.

Plate IV.

Figures 1—5 *Halopsis ocellata* A. Agassiz.

Figure 1. A male specimen, 35 mm wide, seen from the aboral side. — Iceland, "Thor" stat. 179 (04). — × 2.

— 2. Part of the bell-margin seen from the abaxial side; showing 5 tentacles, 4 cirri, 1 marginal vesicle, and the velum. — From a specimen, 35 mm wide, from the Vestman Islands. — × 28.

— 3. Mature male gonad. — From the same specimen as fig. 1. — × 5.

— 4. Mature female gonad. — From a specimen, 30 mm wide, from between Iceland and the Faeroe Islands. — × 5.

— 5. Bifurcated female gonad. — Iceland, "Thor" stat. 174 (04). — × 5.

Figures 6—10 *Tiaropsis multicirrata* (M. Sars).

— 6. Transverse section through radial canal with mature male gonads. — Hrafnsfjord, Iceland. — × 28.

— 7. Transverse section through radial canal with immature female gonads. — Veidileysafjord, Iceland. — × 28.

— 8. Transverse section through radial canal with mature female gonads. Most of the eggs have been detached, some eggs have not yet penetrated the ectodermal epithelium. — Dyrefjord, Iceland, August 4th 1896. — × 30.

— 9. Lateral view of the proximal part of a radial canal with female gonads, showing a number of mature eggs situated on the outer side of the lateral wall of the canal. — From the same specimen. — × 15.

— 10. The same radial canal seen from the ventral edge. — × 15.

Figures 11—13 *Phialidium islandicum* nov. spec.

— 11. A specimen seen from the aboral side. — Iceland, "Thor" stat. 176 (04). — × 2.

— 12. Manubrium seen obliquely from the aboral side. — From another specimen from the same locality. — × 8.

— 13. Section through the circular vessel and a marginal vesicle. — Iceland, "Thor" stat. 266 (04). — × 220.

— 14. *Phialidium hemisphæricum* (Gronovius). — Section through the circular vessel and a marginal vesicle. — Myri Bugt, Iceland, July 24th 1904. — × 220.

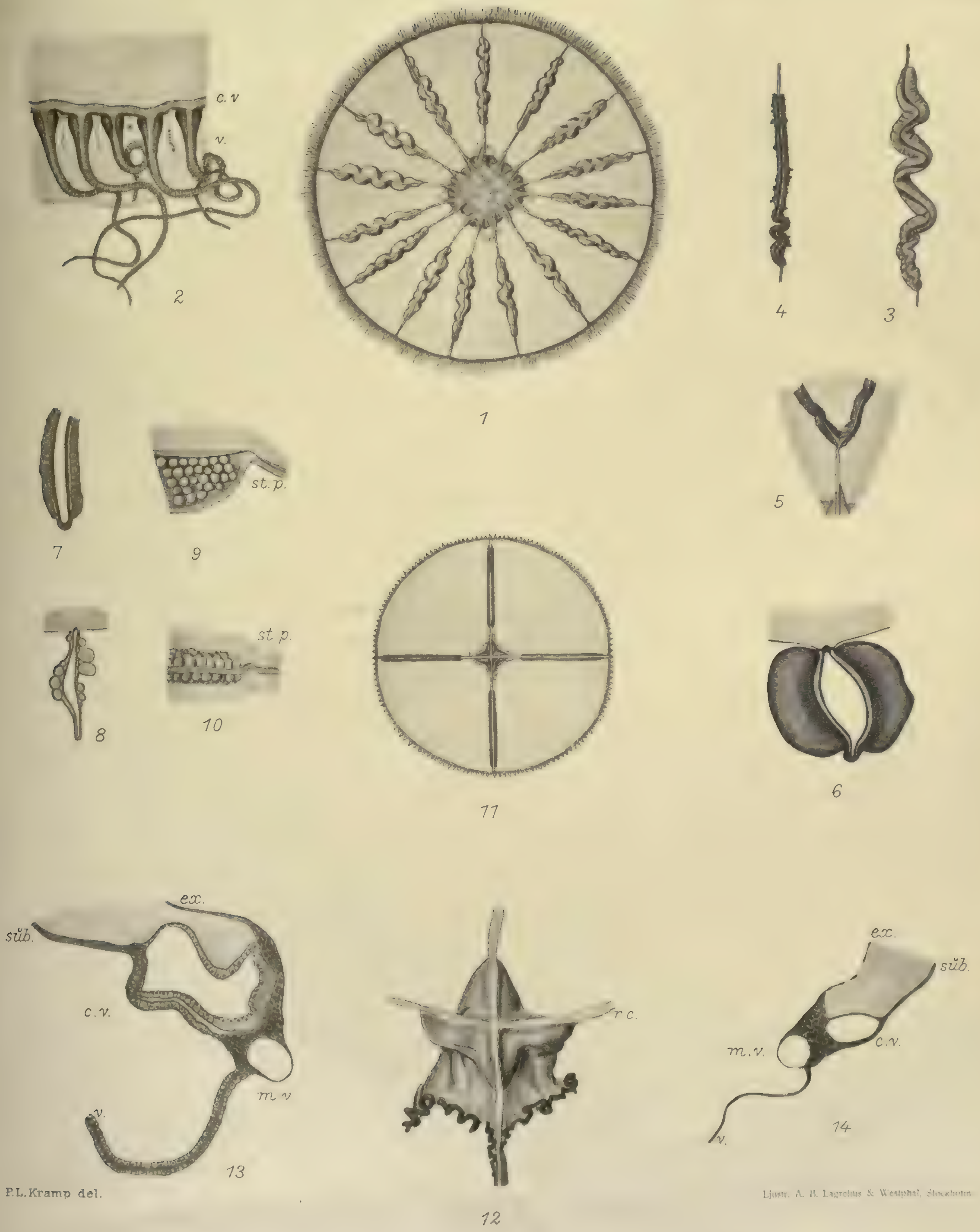

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Plate V.

Plate V.

Figures 1—2. *Phialidium islandicum* nov. spec.

Figure 1. Part of the bell-margin, showing marginal vesicles alternating with the tentacles. — Iceland, "Thor" stat. 176 (04). — × 20.

— 2. Longitudinal section through a tentacular bulb, perpendicularly to the circular vessel. — Iceland, "Thor" stat. 266 (04). — × 50.

— 3. *Phialidium hemisphœricum* (Gronovius). — Longitudinal section through a tentacular bulb, perpendicularly to the circular vessel. — Myri Bugt, Iceland. — × 50.

Figures 4—10. *Tima bairdii* (Johnston).

— 4. Dorsall wall of the stomach, showing the four deep grooves and the entrances to the four radial canals; the two entrances to the left are closed, the two others are open, showing the transversal folds in the proximal part of the radial canals. The lateral walls of the stomach have been removed. — From a Danish specimen. — × 8.

— 5. Lateral view of the manubrium and the lower end of the stomachal peduncle; showing the four large, folded lips and the triangular pouches between the dorsal wall of the stomach and the peduncle. The cross-shaped figure, along the arms of which the stomach is attached to the peduncle, is discerned through the jelly of the latter. In this specimen the "cross-arms" do not meet exactly in the centre. — From a Danish specimen. — × 8.

— 6. Part of the bell-margin, seen from the abaxial side, with two tentacles (observe the abaxial spur-like projection at the base of the bulbs) and a number of marginal warts and marginal vesicles. — From a Danish specimen. — × 5.

— 7. Lateral view of a tentacular bulb. The margin of the umbrella, the circular vessel, and the velum are seen in section. The basal spur on the tentacular bulb is distinctly visible. Above the tentacle is seen the rounded gelatinous protuberance of the exumbrella. — × 5.

— 8. Section through the bell-margin and a tentacular bulb; showing the entodermal, basal spur, covered by the epithelium of the exumbrella. — × 12.

— 9. Section through the bell-margin. The section has passed through the middle of a marginal wart with a marginal vesicle situated on the adaxial side close to the velum. — × 65.

— 10. Transverse section through a radial canal (the part on the stomachal peduncle) with male gonads; showing the mode of attachment to the subumbrella, mentioned in the text, p. 103. — × 65.

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THE INGOLF-EXPEDITION

1895—1896.

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
1	62° 30′	8° 21′	132	7°2	24	63° 06′	56° 00′	1199	2°4	45	61° 32′	9° 43′	643	4°17
2	63° 04′	9° 22′	262	5°3	25	63° 30′	54° 25′	582	3°3	46	61° 32′	11° 36′	720	2°40
3	63° 35′	10° 24′	272	0°5		63° 51′	53° 03′	136		47	61° 32′	13° 40′	950	3°23
4	64° 07′	11° 12′	237	2°5	26	63° 57′	52° 41′	34	0°6	48	61° 32′	15° 11′	1150	3°17
5	64° 40′	12° 09′	155			64° 37′	54° 24′	109		49	62° 07′	15° 07′	1120	2°91
6	63° 43′	14° 34′	90	7°0	27	64° 54′	55° 10′	393	3°8	50	62° 43′	15° 07′	1020	3°13
7	63° 13′	15° 41′	600	4°5	28	65° 14′	55° 42′	420	3°5	51	64° 15′	14° 22′	68	7°32
8	63° 56′	24° 40′	136	6°0	29	65° 34′	54° 31′	68	0°2	52	63° 57′	13° 32′	420	7°87
9	64° 18′	27° 00′	295	5°8	30	66° 50′	54° 28′	22	1°05	53	63° 15′	15° 07′	795	3°08
10	64° 24′	28° 50′	788	3°5	31	66° 35′	55° 54′	88	1°6	54	63° 08′	15° 40′	691	3°9
11	64° 34′	31° 12′	1300	1°6	32	66° 35′	56° 38′	318	3°9	55	63° 33′	15° 02′	316	5°9
12	64° 38′	32° 37′	1040	0°3	33	67° 57′	55° 30′	35	0°8	56	64° 00′	15° 09′	68	7°57
13	64° 47′	34° 33′	622	3°0	34	65° 17′	54° 17′	55		57	63° 37′	13° 02′	350	3°4
14	64° 45′	35° 05′	176	4°4	35	65° 16′	55° 05′	362	3°6	58	64° 25′	12° 09′	211	0°8
15	66° 18′	25° 59′	330	—0°75	36	61° 50′	56° 21′	1435	1°5	59	65° 00′	11° 16′	310	—0°1
16	65° 43′	26° 58′	250	6°1	37	60° 17′	54° 05′	1715	1°4	60	65° 09′	12° 27′	124	0°9
17	62° 49′	26° 55′	745	3°4	38	59° 12′	51° 05′	1870	1°3	61	65° 03′	13° 06′	55	0°4
18	61° 44′	30° 29′	1135	3°0	39	62° 00′	22° 38′	865	2°9	62	63° 18′	19° 12′	72	7°92
19	60° 29′	34° 14′	1566	2°4	40	62° 00′	21° 36′	845	3°3	63	62° 40′	19° 05′	800	4°0
20	58° 20′	40° 48′	1695	1°5	41	61° 39′	17° 10′	1245	2°0	64	62° 06′	19° 00′	1041	3°1
21	58° 01′	44° 45′	1330	2°4	42	61° 41′	10° 17′	625	0°4	65	61° 33′	19° 00′	1089	3°0
22	58° 10′	48° 25′	1845	1°4	43	61° 42′	10° 11′	645	0°05	66	61° 33′	20° 43′	1128	3°3
23	60° 43′	56° 00′	Only the Plankton-Net used		44	61° 42′	9° 36′	545	4°8	67	61° 30′	22° 30′	975	3°0

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
68	62° 06′	22° 30′	843	3°4	92	64° 44′	32° 52′	976	1°4	118	68° 27′	8° 20′	1060	—1°0
69	62° 40′	22° 17′	589	3°9	93	64° 24′	35° 14′	767	1°46	119	67° 53′	10° 19′	1010	—1°0
70	63° 09′	22° 05′	134	7°0	94	64° 56′	36° 19′	204	4°1	120	67° 29′	11° 32′	885	—1°0
71	63° 46′	22° 03′	46			65° 31′	30° 45′	213		121	66° 59′	13° 11′	529	—0°7
72	63° 12′	23° 04′	197	6°7	95	65° 14′	30° 39′	752	2°1	122	66° 42′	14° 44′	115	1°8
73	62° 58′	23° 28′	486	5°5	96	65° 24′	29° 00′	735	1°2	123	66° 52′	15° 40′	145	2°0
74	62° 17′	24° 36′	695	4°2	97	65° 28′	27° 39′	450	5°5	124	67° 40′	15° 40′	495	—0°6
	61° 57′	25° 35′	761		98	65° 38′	26° 27′	138	5°9	125	68° 08′	16° 02′	729	—0°8
	61° 28′	25° 06′	829		99	66° 13′	25° 53′	187	6°1	126	67° 19′	15° 52′	293	—0°5
75	61° 28′	26° 25′	780	4°3	100	66° 23′	14° 02′	59	0°4	127	66° 33′	20° 05′	44	5°6
76	60° 50′	26° 50′	806	4°1	101	66° 23′	12° 05′	537	—0°7	128	66° 50′	20° 02′	194	0°6
77	60° 10′	26° 59′	951	3°6	102	66° 23′	10° 26′	750	—0°9	129	66° 35′	23° 47′	117	6°5
78	60° 37′	27° 52′	799	4°5	103	66° 23′	8° 52′	579	—0°6	130	63° 00′	20° 40′	338	6°55
79	60° 52′	28° 58′	653	4°4	104	66° 23′	7° 25′	957	—1°1	131	63° 00′	19° 09′	698	4°7
80	61° 02′	29° 32′	935	4°0	105	65° 34′	7° 31′	762	—0°8	132	63° 00′	17° 04′	747	4°6
81	61° 44′	27° 00′	485	6°1	106	65° 34′	8° 54′	447	—0°6	133	63° 14′	11° 24′	230	2°2
82	61° 55′	27° 28′	824	4°1		65° 29′	8° 40′	466		134	62° 34′	10° 26′	299	4°1
83	62° 25′	28° 30′	912	3°5	107	65° 33′	10° 28′	492	—0°3	135	62° 48′	9° 48′	270	0°4
	62° 36′	26° 01′	472		108	65° 30′	12° 00′	97	1°1	136	63° 01′	9° 11′	256	4°8
	62° 36′	25° 30′	401		109	65° 29′	13° 25′	38	1°5	137	63° 14′	8° 31′	297	—0°6
84	62° 58′	25° 24′	633	4°8	110	66° 44′	11° 33′	781	—0°8	138	63° 26′	7° 56′	471	—0°6
85	63° 21′	25° 21′	170		111	67° 14′	8° 48′	860	—0°9	139	63° 36′	7° 30′	702	—0°6
86	65° 03′6	23° 47′6	76		112	67° 57′	6° 44′	1267	—1°1	140	63° 29′	6° 57′	780	—0°9
87	65° 02′2	23° 56′2	110		113	69° 31′	7° 06′	1309	—1°0	141	63° 22′	6° 58′	679	—0°6
88	64° 58′	24° 25′	76	6°9	114	70° 36′	7° 29′	773	—1°0	142	63° 07′	7° 05′	587	—0°6
89	64° 45′	27° 20′	310	8°4	115	70° 50′	8° 29′	86	0°1	143	62° 58′	7° 09′	388	—0°4
90	64° 45′	29° 06′	568	4°4	116	70° 05′	8° 26′	371	—0°4	144	62° 49′	7° 12′	276	1°6
91	64° 44′	31° 00′	1236	3°1	117	69° 13′	8° 23′	1003	—1°0					

THE DANISH INGOLF-EXPEDITION.

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THE DANISH

INGOLF-EXPEDITION.

VOL. V, PART 9.

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OSKAR CARLGREN, ACTINIARIA. I.

PUBLISHED AT THE COST OF THE GOVERNMENT

BY

THE DIRECTION OF THE ZOOLOGICAL MUSEUM OF THE UNIVERSITY.

COPENHAGEN.

H. HAGERUP.

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9.

ACTINIARIA

PART I.

BY

OSKAR CARLGREN.

WITH 4 PLATES AND 210 FIGURES IN THE TEXT.

COPENHAGEN.
PRINTED BY BIANCO LUNO.
1921.

The paper on the Actiniaria, of which I now present the first part, has been drawn up according to the same plan as my reports on the Ceriantharia and Zoantharia of the Ingolf-Expedition. The main part of the material examined by myself belongs to the museums in Copenhagen and Stockholm. I have had at my disposal a rather great collection mainly enclosing the forms dredged by Rømer and Schaudinn during their journey around the Spitzbergen, and I have also examined smaller collections from the museums in Upsala, Gothenburg, Lund, Christiania, Bergen, Drontheim, Tromsø, Francfort on the Main and Petrograd. I beg to express my best thanks to all, who have supported my work through lending of material.

The paper on the Ingolf-Actiniaria will be divided into four sections:

1) Description of the species.

2) Survey of the literature with critical notes on the arctic and northern Actiniaria.

3) Distribution of the species.

4) Contribution to the anatomy, genealogy and classification of the Actiniaria.

In the present paper I have described all families occurring in the arctic and northern waters excepting the forms which have been referred to the old family Sagartiidae.

I have given special attention here to the size and distribution of the nematocysts and spirocysts. As before emphasized by me the stinging capsules are of great importance to the classification. Nearly related genera show great agreement in the appearance and distribution of the nematocysts, and the species are often characterised by the different sizes of these latter, though in many cases the differences are not great. In fact I think that it is impossible to put up a good system of the Actiniaria without considering the stinging capsules. Concerning my statement of the breadth of the stinging capsules I will remark that it is approximate.

Section I.

Description of the species.

Subtribus Protactininae.

Family *Gonactiniidae.*

Diagnosis: Protactininae with flattened, disclike, proximal body-end. Column of the same structure as the tentacles with spirocysts and a more or less strongly developed, longitudinal muscle- and nerve-layer, not capable of involution. No distinct sphincter. Longitudinal muscles of the tentacles ectodermal (in *Gonactinia* sometimes with a little tendency to be meso-ectodermal?) even as the radial muscles of the oral disc. Actinopharynx not rudimentary, with longitudinal muscles and often with spirocysts, with weak siphonoglyphes or without. Mesenteries typically arranged in cycles, each pair of mesenteries, except the directives, with the longitudinal muscles facing each other. 8 (the "*Edwardsia*-mesenteries"), 10 or 12 mesenteries perfect. Reproductive organs arranged in the usual manner, as a rule on all perfect mesenteries. Muscles of the mesenteries weak, especially the parieto-basilar muscles. No ciliated lobes to the mesenterial filaments. Stomata absent or only the oral stomata present.

In this family I have previously (1900) placed the genera *Protanthea, Gonactinia* and preliminarily also *Boloceroides*. Concerning the last genus, which has formerly been referred to the Boloceriidae, its affinity with *Protanthea* and *Gonactinia* has been admitted by Pax (1914 p. 608) and Poche (1914 p. 97), whereas Mc. Murrich (1904 p. 255) and later Stephenson (1918 p. 6) have not accepted it as belonging to the family Gonactiniidae. These latter authors, however, have not given any important arguments for their point of view, no more have they refuted my objections against the affinity of the genus with the Boloceriidae (vide Carlgren 1911). As I have pointed out, one of the differences between *Protanthea* and *Gonactinia* on one side and *Boloceroides* on the other is that the former are devoid of ciliated streaks on the filaments, the latter not. In 1900 I also proposed to establish a special subfamily for the genus *Boloceroides*. Though I am continually of opinion that *Boloceroides* is nearly related to the above-mentioned species, I think that it may be the most practical to refer it with *Bunodeopsis* and *Alicia* to the family Aliciidae, a heterogeneous family, as I will show in another paper.

To the family Gonactiniidae I furthermore refer the genus *Sideractis*. The diagnoses of this family and of the genera *Protanthea* and *Gonactinia* are a little altered and more detailed here.

Genus **Protanthea** Carlgr.

Diagnosis: Gonactiniidae with smooth column which is broader in the distal part than in the proximal one. Longitudinal muscle layer and nerve-stratum very well developed. Tentacles long, numerous, at the base a little constricted, in the apex not swollen. Oral disc conical. Only the 8 "*Edwardsia*-mesenteries" perfect. All stronger mesenteries with filaments and reproductive organs. No differentiation into filament-mesenteries and genital-filament-mesenteries. Sterile, weak mesenteries in variable numbers in the distal part of the body.

Protanthea simplex Carlgr.

Protanthea simplex sp. n. Carlgren 1891 a p. 81, textfigs.

— — Carlgr., Carlgren 1893 p. 24. Pl. 1 figs. 9, 16, Pl. 3. figs. 1—7, Pl. 4. figs. 3—10. Pl. 10. fig. 2. 1905 p. 158, Arndt 1912, p. 123, Grieg 1913, p. 143.

Diagnosis: Body cup-like with 24 rather distinct, longitudinal furrows, without fossa. Margin undulated. Tentacles numerous from about 100 to 160 in 5 or 6 cycles, the inner ones about the length of the column or longer, the outer ones considerably shorter. Actinopharynx with numerous, weak, longitudinal furrows and 6 deeper of which 2 form the siphonoglyphes which are aborally prolongated. Pairs of filament- and genital- mesenteries 6 + 6 = 12 in the whole length of the body. Numerous sterile, filament-lacking mesenteries in the distal part of the body, in number corresponding to that of the tentacles. Longitudinal muscles of the mesenteries weak, with low folds, form no pennons. Parieto-basilar muscles weak, not folded. No stomata. Nematocysts in the ectoderm of the column rib-like, partly 17—22 × 1,5 to 2 μ, partly 29—50 × 3—3,5 μ, in the tentacles partly 19—24 × 2—2,5 μ, partly 44—58 × 3,5—4 μ, the latter very numerous and closely arranged in the distal part (batteries of stinging cells), in the actinopharynx 22—31 × 2—2,5 μ. Spirocysts in the ectoderm of the column and tentacles from about 22 × 2,5 μ to 43 × 5 μ, very numerous in the column and in the proximal part of the tentacles, in the distal part of the latter more sparse. Actinopharynx without spirocysts.

Colour: salmon-red, with tentacles a little paler, or white. Reproductive organs white or salmon-red.

Dimensions: Length of the column to about 1,5 cm. Breadth of the oral disc to about 1,5 cm. Diameter of the pedal disc to about 1 cm.

Occurrence: Sweden. Gullmarfiord (Saltkällefiord, Skårbergen, Börsås, Orstadhufvud, Humlesäcken) (Carlgren and others) from some few to 30 fathoms on Ascidiae, Serpula- and Chaetopterus tubes, rather common. Koster Isl. E. off Hamnholmen 80—100 m.

Norway. Christianiafjord, Dröbak (Carlgren 1899) Hardangerfiord, Jonanes, Straumastein 100—400 m (teste Grieg), Oxen 100—150 fms. (Asbjörnsen, labelled *Anthea cereus*), Osterfiord (Appellöf, teste Grieg). Drontheimfiord, Röberg 200—400 m. (Arwidsson, Arndt and others) Skarnsund 100—200 m on Lophohelia (Oestergren, Arndt, Mortensen), Lofoten. Tysfiord 500 m on Lophohelia (Nordgaard).

In 1893 I have given a detailed description of this interesting, very primitive species, and therefore I here only add some statements especially concerning the size and distribution of the stinging capsules. The spirocysts in the ectoderm of the column are very numerous, their size variates from about 22 × 2,5 μ to 43 × 5 μ. In the tentacles they are of about the same size as in the column, and numerous in the proximal part, but sparse in the apex, which condition evidently is correlated with the unequal occurrence of the nematocysts in these parts (compare below). In the ectoderm of the actinopharynx I have not found any spirocysts in maceration-preparations. In my description of the species 1893 I have also expressed my suspicion that the very few spirocysts I observed in this part probably are not normal components of the actinopharynx. In the ectoderm of the column the nematocysts are numerous and partly of a smaller type 17—22 × 1,5 μ, partly of a larger one 29—50 × 3—3,5 μ. In the latter the basal part of the spiral thread is often discernible. Furthermore I have seen a few nematocysts with the thread thrown out. These capsules were of larger dimensions (60—80 × 4—4,5 μ). In the tentacles I have also observed nematocysts of two unequal dimensions, partly 19—24 × 2—2,5 μ, partly 44—58 × 3,5—4 μ. The former are rather numerous, the latter very much so in the summit of the tentacles, where they are closely packed together, so that they completely intercept the view of all other nematocysts and cells, hereby causing the distal part of the tentacles to form strong stinging batteries. Further down on the tentacles these capsules are more sparse, although also here they generally occur, the spirocysts at the same time appearing in greater numbers. The nematocysts of the actinopharynx are rather common and comparatively small (22—31 × 2—2,5 μ). Sometimes I have also here observed such large nematocysts as in the tentacles, but probably they have only been attached to the actinopharynx and belong to the tentacles. The basal part of the spiral thread is often discernible in the nematocysts of the actinopharynx. In expanded as well as sometimes in contracted state small papilliform elevations on the column are to be observed ("weissliche Flecke" Carlgren 1893) almost as in *Sideractis*, though here perhaps not so distinct. In these places the ectoderm is a little thickened, I have, however, not found any real difference in the structure of the ectoderm of the papilliform elevations and of that of the grooves between them. The shallow furrows are not always distinct, especially when the actinopharynx is expanded. In larger specimens I have noticed a greater number of tentacles than before stated by me.

Genus **Gonactinia** M. Sars.

Diagnosis: Gonactiniidae with smooth, cylindrical column. Margin not undulated. Longitudinal muscle- and nerve-layer well developed. Tentacles long, few, at the base not constricted, not swollen in the apex. Oral disc flattened or conical. Perfect mesenteries 7—10, commonly 8 (the *Edwardsia*-mesenteries"). The stronger mesenteries differentiated in filament-mesenteries and genital-filament-mesenteries. The weaker mesenteries without filaments. Arrangement of the mesenteries often irregular, probably in connection with the reproduction by transverse partition.

Gonactinia prolifera (M. Sars.) Sars.

Actinia prolifera n. sp. M. Sars 1835 p. 3, 11 Pl. 2, fig. 6.

Gonactinia prolifera Sars, M. Sars 1851 p. 142, 1853 p. 379, 386. Danielsen & Koren 1856 p. 87. Koren, 1857, p. 93. Andres, 1883, p. 366. Blochmann & Hilger, 1888, p. 385, Pl. 14, 15. Haddon, 1889, p. 340, textfig. 2. Prouho, 1891, p. 247, Pl. 9, figs. 1—3. Carlgren, 1893, p. 31, Pl. 1, fig. 14, Pl. 4, figs. 11—13; 1904, p. 546, fig. 1. Appellöf, 1893, p. 27. 1895, p. 11. Grieg, 1913, p. 143. Kerb, 1913, p. 1. textfigs. 1—5. Pax, 1915.

Diagnosis: Tentacles 14—18 commonly 16, of about the same length as the column, almost all of the same size. Actinopharynx of about half the length of the column with longitudinal furrows corresponding to the insertions of the mesenteries. Siphonoglyphes a little differentiated with aboral prolongations. Spirocysts in the ectoderm of the column about 17—22 × 2,5 μ, in the tentacles 13 × 1—24 × 2,5 μ. Actinopharynx without spirocysts. Nematocysts in the ectoderm of the column about 17—29 × 2,5—3 μ, in the tentacles partly 22—24 × 2 μ, partly 29—43 × 3,5—4 μ, the latter numerous in the distal part. Only the 4 lateral "*Edwardsia*-mesenteries" with both reproductive organs and filaments. Directive mesenteries and often the 5th couple with filaments. Mesenteries of the second cycle only common in the dorsolateral exocoels. Arrangement of the mesenteries often irregular (compare above!). Longitudinal muscles of the mesenteries and the parieto-basilar muscles very weak. No stomata.

Colour: Flesh-coloured or white with transparent inner organs.

Dimensions: Length of the column and the tentacles about 0,3 cm.

Occurrence: Sweden. Gullmarfiord in several places attached to sea-weed, Serpula-tubes or mussel-shells (Carlgren). Väderöarne (Zool. Stat. 1911) to shells of Lima, Kosterfiord. Hamnholmen 106—80 m. (Zool. Stat. 1910). North-Sea without distinct locality (Uddström).

Norway. Coast of Bergen, the islands off Bergen and the outer parts of the fiord. Solsvik Bergen 20—30 m (Kerb), Herlöfiord (teste Appellöf), Hardangerfiord, Straumastein, Saetvetnes 10—25 m (teste Grieg), Slaetholmen (M. Sars), Bougeströmmen, Manger (M. Sars), Gibostad (Dons), Hammarfest M. Sars).

Coast of Murman, Olenja Guba littoral (teste Pax).

Further distribution: Mediterranean (Prouho).

Remarks: This species has been described before in detail by Blochmann and Hilger 1888 and by myself 1893.

Concerning the distribution and size of the stinging capsules I will state as follows: In the ectoderm of the column there are nematocysts as well as spirocysts, rather numerous, the size of the former variates from about 17—29 × 2,5 μ, the latter from about 17—22 × 2,5 μ, possibly there are also smaller spirocysts, what I have not been able to decide. In the ectoderm of the tentacles the spirocysts appear everywhere in great numbers, they variate from about 13 × 1 μ to 24 × 2,5 μ. The nematocysts were of two different sizes, partly smaller and not so numerous, 22—24 × 2 μ, partly larger, 29—43 × 3,5 μ. On one part of the latter the basal part of the spiral thread was discernible. As in *Protanthea* the greater part of the large nematocysts were concentrated in the summit of the tentacles, further down they were much fewer in numbers. The distal part of the tentacles also forms rather strong batteries of nematocysts. I have not been able to decide the size of the nematocysts in the actinopharynx, as it is very difficult to get positive maceration-preparations of the little actinopharynx. Spirocysts appear to be absent here.

In a publication (1913) Kerb discusses the transversal partition of *Gonactinia*, and verifies as myself (1893) that the reproductive organs develop as well in the distal as in the proximal dividing pieces. Furthermore he means having found that also the proximal piece divides transversely. I am, however, of opinion that his experiments are not thoroughly proving, Kerb having started not from a chain of 3 indiduals, but only from one of 2 individuals. Under such circumstances it is therefore possible that the proximal piece dividing a second time was a middle piece, and not the primitive proximal piece of the chain. A chain of 3 individuals is namely to my mind very common in *Gonactinia*. (Carlgren 1904 p. 145. Kerb has evidently overlooked this paper). Thus of 10 transversely dividing specimens of *Gonactinia*, collected by Sars himself, no less than half the specimens were in tridivision, and yet *Sars* himself states having observed only a single one. In the above-mentioned paper I have tried to explain the reason why the chain of three individuals is overlooked. Besides it is possible that under very favourable circumstances the partition takes place so rapidly that the proximal piece is dropped before the middle piece is erected. In order to get a binding evidence that the most proximal piece divides again, it is necessary to follow the development of the division in a chain of 3 individuals. The experiments of Kerb only show that a proximal part is able to divide a second time, but leave undecided, whether it was a primitive proximal part or a middle piece that divided transversely.

Genus **Sideractis** Dan.

Diagnosis: Gonactiniidae with weak muscularity, without sphincter. Column and actinopharynx with weak, ectodermal, longitudinal muscles extending into the indistinct pedal disc. Column with spirocysts, but without nematocysts. Tentacles hexamerously arranged at least to the stadium of 24 tentacles, conical, of ordinary length, the inner ones considerably longer than the outer ones. Apex of the tentacles hemispherical, smooth, with batteries of large, stinging capsules, the peduncle of the tentacles with small, papilliform elevations which also occur, though less numerously, on the oral disc and on the distal part of the column. Oral disc conical. Actinopharynx longitudinally sulcated, without differentiated siphonoglyphes. 6 pairs of perfect mesenteries with filaments, and fertile. Variable numbers of weak mesenteries, sterile and without filaments. Parieto-basilar muscles weak. Typical nematocysts absent.

The above diagnosis of the genus completely differs from that given by Danielssen 1890. Above everything I must emphasize that the statement of Danielssen that the circular muscles are mesogloeal, is wrong. Besides, the description of the anatomical conditions by Danielssen is on several points erroneous and very incomplete. After an examination of well preserved material, compared with that of Danielssen, the genus turned out to be a very primitive form belonging to the family Gonactiniidae.

Danielssen has established the genus as a separate family, Sideractidae, which in his opinion would be related to the family Boloceriidae. Also Mc. Murrich (1893 p. 153) adopts this opinion. This is, however not the case, as the following description will clearly show. Verrill (1899 p. 143, 144) declares that the genus probably belongs to the Paractidae. Now my suggestion (1902 p. 43) that the genus is related to the family Antheadae (Actiniidae) is correct — at the time of this statement I had only had the opportunity of examining the most distal part of the original specimen in which only fragments of the column were left. In reality the genus is closely related to the family Gonactiniidae. It is true that it differs in several respects from *Protanthea* and *Gonactinia*, above all as regards the structure of the tentacles and the presence of a greater number of perfect mesenteries, but in spite of these differences I think that it is not necessary, at least not at present, to establish a special family for *Sideractis*, which establishment in such a case would have to be founded for one thing on the structure of the tentacles and on the greater number of perfect mesenteries. Thus I refer *Sideractis* to the family Gonactiniidae together with *Protanthea* and *Gonactinia*. The genus contains only one known species, *Sideractis glacialis* Dan.

Sideractis glacialis Dan.

Pl. 1. Figs. 17—19.

Sideractis glacialis n. sp. Danielssen 1890 p. 14. Pl. 1. fig. 1. P. 7. figs. 10, 12.

Diagnosis: Pedal disc wide, indistinct, with undulated border. Column with longitudinal furrows corresponding to the insertions of the mesenteries. Tentacles 24—38, in the stadium of 24 tentacles arranged in three cycles (6 + 6 + 12). Arrangement of the tentacles in later stadia more irregular through the development of new tentacles in the transversal plane (always?). Papilliform elevations composed of ectodermal thickenings, containing numerous spirocysts. Stinging capsules of several kinds in the apex of the tentacles, partly typical spirocysts, partly capsules with thread densely rolled-up (size: 86—106 × 12—14 μ), partly of equal width with the basal part of the spiral thread distinct and of two different sizes 55—79 × 5 μ and 24—29 × 3 μ. Stinging capsules in the actinopharynx with thread densely rolled-up, 53—60 × 13—17 μ, and others of equal width as those in the apex of the tentacles, 24—31 (seldom 46) × 5—6 μ.

Colour: Almost transparent. Column and tentacles greenly shimmering, the oral disc redly so. Apex of the tentacles with a white annulus. Actinopharynx and filaments pale red (Danielssen).

Dimensions: In living state. Diameter of the pedal disc 2 cm. Height of the column 0,5 cm (Danielssen). In preserved state: 1) The type specimen: Diameter of the oral disc 1,5 cm. Length of the inner tentacles 0,6 cm breadth 0,25 cm, length of the outer tentacles 0,35—0,4 cm. 2) The best preserved specimen from Sunde: Length of the column 0,4 cm, cone of the oral disc 0,15 in height. Inner tentacles 0,35, outer tentacles 0,2 cm.

Occurrence: 70°41′ N. 10°10′ W. 263 fms. Temperature at the bottom ÷ 0,3, brown clay with stones. (Norw. North-Atl. Exp. 1877) 1 sp.

Norway. Sunde, mouth of the Hardangerfiord proper (G. O. Sars) 2 sp.

Exterior aspect: The indistinct pedal disc was extended, thin and membranous in the original specimen, in one specimen from Sunde completely pulled off, in the other one (Pl. 1. figs. 17, 18) partly rather much damaged, and the filaments of one side pressed out. Though the preserving of it was anything but good, I do, however, think that I am able to decide that it was furnished with radial furrows. In sections through the pedal disc deep incisions, where the mesenteries inserate, are namely to be observed. Danielssen also says that the border of the pedal disc is undulated. The column is low or high according to the more or less contracted state of the body (the specimens from Sunde were both cylindrical and very much contracted). In the reproduced specimen (Pl. 1 fig. 17) distinct, longitudinal furrows appear on the column; on the distal part one can see small, papilliform elevations of the same appearance as on the proximal parts of the tentacles, but these elevations are much more indistinct here than there, and sometimes not visible at all.

The tentacles are of ordinary length, but broad. Their form is conical, in the apex they are hemispherical and smooth, while the larger, proximal part bears small, papilliform elevations, very closely packed; in the extended, reproduced specimen and in the type specimen (Pl. 1. fig. 19) they are very distinct. On the other, very contracted specimen from Sunde these elevations are not visible, neither on the tentacles nor on the oral disc or the column. The inner tentacles are considerably longer and broader than the outer ones. The reproduced specimen had 24 tentacles (6—6—12), the other specimen from Sunde 28. Besides the 24 tentacles arranged in the usual manner there are on each side of the directive plane 2 tentacles developed in the transversal plane (in the primary, lateral exocoels). Danielssen declares that his specimen is provided with 32 tentacles, octomerously arranged. That is, however, not so, in fact there are 38 tentacles developed. On one side 18 tentacles namely appear, on the other 20. It is difficult to find out how the tentacles really are arranged, because of the bad preservation of the type specimen. I think, however, that on basis of my notes I can make the conclusion that the richer development of tentacles takes place mainly in the transversal plane. It is also possible that after the stadium of 24 tentacles another arrangement of the tentacles appears; I am really more inclined to think that in the type specimen the arrangement is decamerous instead of octomerous. Perhaps this arrangement is only temporary, so that the animal after having reached the stadium of 48 tentacles (if it obtains so many) rearranges the tentacles hexamerously. Concerning the mesenteries I have observed such a rearrangement to take place in *Condylactis georgiana* (Carlgren 1898 p. 11, 12).

The oral disc is on the extended specimen conical, with the more or less split-like mouth in the apex of the cone (Pl. 1, fig. 18). It is wide and furnished with radial furrows extending into the actinopharynx, whereby the margin of the mouth becomes of an indistinctly crenellated appearance. On the oral disc we find the same papilliform elevations as on the tentacles, though they are smaller and more indistinct. The actinopharynx is longitudinally sulcated. Danielssen declares that there are 8 furrows, on the specimens from Sunde there are about 14. The furrows in the directive plane differ in no respect from the others.

Anatomical description. Only the distal part of the original specimen remained after the examination by Danielssen, and even of this a large piece was not well preserved. For the anatomical examination I have cut out a piece with 4 tentacles. Furthermore I have sectionised the best conserved specimen from Sunde, mostly transversally.

The pedal disc possesses, judging from the specimen from Sunde, a thick ectoderm containing numerous mucus-cells. Whether spirocysts occur also here I cannot decide, as maceration-preparations do not give any positive result, because of the unfavourable conservation and the sticking of the filaments to the pedal disc. On the other hand I have in sections found nematocysts agreeing with both smaller kinds of

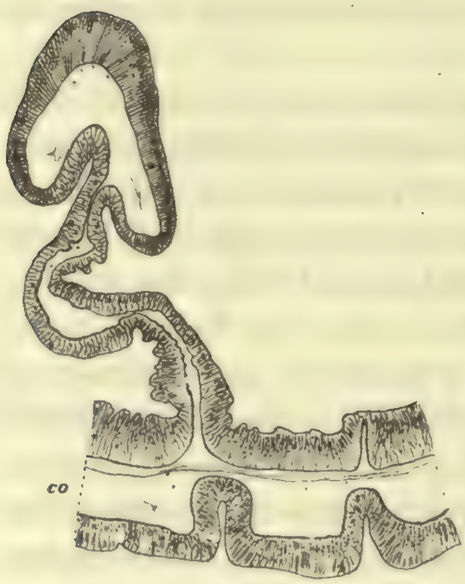


Fig. 1.

Fig. 2.

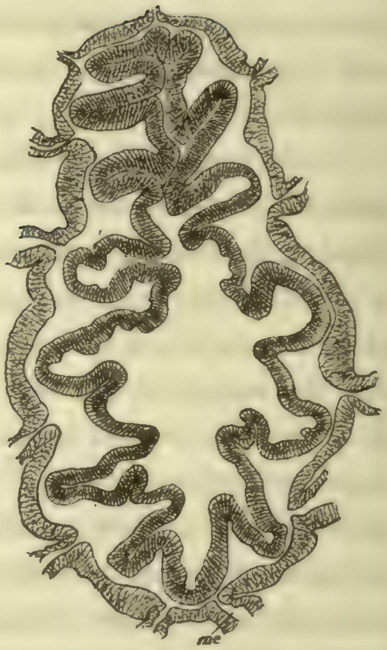


Fig 3.

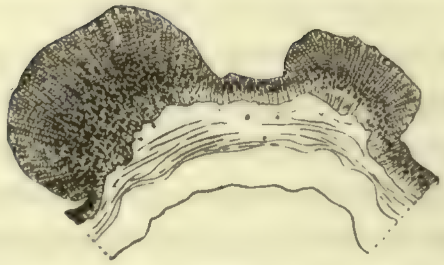


Fig. 4.

Fig. 5.

Sideractis glacialis. Textfig. 1. Transversal section through one part of the column (*co*), a perfect and an imperfect mesentery at the transition of the actinopharynx in the filaments. Fig. 2. Longitudinal section through the distal part of a tentacle. Fig. 3. Transversal section through the actinopharynx and the bases of the mesenteries (*me*). Fig. 4. Part of the tentacle in section, showing the papillae containing spirocysts. Fig. 5. Transversal section through the peduncle of a tentacle.

these in the filaments. If spirocysts really are present, they are at any rate very rare. The ectoderm of the pedal disc is provided with very weak, radial muscles. The mesogloea is thin and only at the insertions of the mesenteries very much thickened. It is homogeneous, with sparsely scattered and ramificated cells, the mesogloea has, however, this appearance in all parts of the body.

The ectoderm of the column is of equal height and contains, in addition to the supporting cells, numerous mucus-cells, while I have not observed any granulous gland-cells. It ought to be mentioned that no such cells have been discovered by me in the ectoderm of the tentacles or in the oral disc, only in the filaments and very sparsely in the ectoderm of the actinopharynx they seem to be present. Typical spirocysts are found in the ectoderm of the column, in the small elevations of the distal part they are most numerous, in the proximal part more sparse. The papilliform elevations are almost exclusively thickenings of the ectoderm, only in a small degree the mesogloea takes part in the composition of the papillae which contain very numerous, densely packed spirocysts; the parts of the ectoderm between the papillae are on the other side more destitute of spirocysts. At the base of the ectoderm there is a weak stratum of nerve-fibrillae and nerve-cells and also a distinct, though weak layer of longitudinal muscles (textfig. 1) which are especially conspicuous in preparations stained with iron-haematoxylin. The mesogloea is rather thick between the furrows, while Danielssen says that it is thin. This difference must, however, certainly be referred to the unequal state of contraction of the type specimen and of the specimen from Sunde, examined more in detail by myself. The inner part of the mesogloea is homogeneous here as also in the mesenteries; in the outer parts cells and now and then fibrillae are scattered or accumulated. Danielssen has interpreted the fibrillae as mesogloeal, circular muscles. In reality the circular muscles of the column are very weak and endodermal and form no sphincter. The endoderm is high and provided with numerous mucus-cells.

The ectoderm is higher in the smooth, hemispherical ends of the tentacles than in the the other part of the tentacles which is set with elevations, and much thicker than the mesogloea, and in all places of the same height (textfig. 2). It is characteristic by its abundance of stinging capsules, by which the apex of the tentacles form strong batteries. In addition to common spirocysts of the same appearance as those of the column there are large stinging capsules with densely rolled-up thread and of considerable size (86—108×12—$14\ \mu$ — sometimes there are still larger capsules). Besides, I have here observed very large, irregularly formed capsules, of a granulate appearance and of variable length which are probably stages of development of the former. I have namely found capsules of an intermediate shape, that is to say capsules which in form and granulation agree with the latter, but in the appearance of the spiral thread with the former. All these capsules are, however, rather rare, whereas another sort of capsules is very common. They are drawn out, of equal width, with distinct basal part to the spiral thread and much thinner than the large spirocysts (55—$77 \times 5\ \mu$). Their thread is very twisted and its windings, close by the basal part, very distinct. Stages of development of these capsules with indiscernible thread are also found. At last there appear smaller capsules of the same appearance as the drawn-out capsules but of smaller sizes (24—$29 \times$ about $3\ \mu$). The stratum of nerve-fibrillae is distinct, but not thick, the muscles of the ecto- and endoderm weak. The mesogloea is mostly very thin, the endoderm thick. The proximal part of the tentacles, carrying elevations, is built just as the distal part of the column. The spirocysts are very numerous in the elevations (textfig. 4), mucus-cells are here also rather common, though rarer in the apex of the tentacles. The mesogloea is thick, irregularly and grossly folded and of the same structure as in the column. The endoderm is thinner than the other layers, the endodermal muscles weak. The oral disc is built as the proximal parts of the tentacles, the elevations are, however, not as densely packed. The radial muscles are a little stronger than the longitudinal muscles of the tentacles, and the mesogloea not as much folded as there.

The ectoderm of the actinopharynx makes several folds (compare above), supported by thick balks of the mesogloea (textfig. 3). In addition to numerous supporting cells mucus-cells are rather commonly found in the ectoderm of the actinopharynx, but granular gland-cells very rarely — in maceration-preparations I have only observed few of these latter — furthermore stinging capsules, partly some uncommonly large with strongly twisted thread of the same appearance as those in the tentacles, but a little shorter (53—60 × 13—17 μ), partly smaller ones, almost equally wide and with distinct basal part to the spiral thread (24—31 × 5—6 μ. Very seldom I have observed still larger ones of the same kind (46 × 5 μ); I have also found stinging capsules in different stages of development (compare above). The nerve-layer and the longitudinal muscles are very weak, the mesogloea in the longitudinal ridges thick, and endoderm of the same appearance as in the column. No differentiated siphonoglyphes.

The number of mesenteries in the sectionised specimen from Sunde was 24, of which 6 pairs were perfect, and of these 2 pairs of directives. The twelve mesenteries of the second cycle were regularly developed. They are thin and rise a little out of the column, only in the distal part they are stronger. Danielssen says that there are 16 pairs of perfect and 16 pairs of imperfect mesenteries in the type-specimen. This is, a priori, rather unlikely as the animal had only 38 tentacles. Danielssen is certainly erring here as so many times before. Nevertheless a third imperfect cycle might be present as well in the type-specimen as in the second specimen from Sunde, in as much as more than 24 tentacles occur in both specimens. The muscles of the mesenteries are very weak. The longitudinal muscles are attached to large folds of the mesogloea, (textfig. 1), the parieto-basilar muscles are not folded, and basilar muscles lacking. The mesogloea is thick in the upper part, thin in the lower one, and only at the insertions of the mesenteries it is thickened. The endoderm is rather high with numerous mucus-cells.

The filaments of the mesenteries are simple, without ciliated lobes, and join only on the mesenteries of the first cycle. They enter into the ridges of the actinopharynx without any direct limit (textfig. 1), their structure even much corresponding to that of the actinopharynx. They are very meandrian and of considerable diameter. The gland-cells are rather rare, especially the mucus-cells; the supporting cells numerous, in sections with densely packed nuclei as in the ectoderm of the actinopharynx. The stinging capsules are like those of the actinopharynx. The larger ones with twisted thread are rather rare and 41—62 μ long and about 17 μ broad. Also of these latter I have observed stages of development. They are of variable size and show the same structure as the stinging capsules in the apex of the tentacles. The thinner capsules of equal width are also rather rare and 24—31 μ long and about 7 μ broad. Besides, I have seen some smaller capsules of the same kind (17—19 × 4 μ). In transversal sections the mesogloea shows a T-like appearance. No endodermal limit-streak is found.

The examined species from Sunde was a male with well developed spermatozoa. Only the 6 first mesenteries are fertile. The information, given by Danielssen, that the reproductive organs appear in the imperfect mesenteries, needs confirming.

Family *Ptychodactiidae*.

Diagnosis: Protactininae with pedal disc not well defined from the column. Longitudinal muscle- and nerve-layer in the column weak. Spirocysts in the ectoderm of the column few (or absent?). Sphincter absent or very weak, endodermal. Actinopharynx now very rudimentary, now well-developed, yet always of large diameter and furnished with special arrangements accelerating the circulation. Mesenteries few or numerous, all with reproductive organs. Muscles of the mesenteries weak, typically arranged. Ciliated lobes of the filament absent. Incomplete mesenteries in the distal part above the glandular streak of the filaments with curious structures giving the appearance of a half-funnel. Reproductive organs only in the proximal parts of the mesenteries, the glandular streaks of the filaments more distal.

Genus **Ptychodactis** Appellöf.

Diagnosis: Ptychodactiidae with low but broad column lacking all sorts of papillae. Spirocysts in the ectoderm of the column very rare (or absent?). No sphincter. Tentacles numerous. Actinopharynx short, possibly rudimentary, not distinctly differentiated from the oral disc, with curled aboral prolongations on the stronger mesenteries. No siphonoglyphes. Mesenteries numerous, those of the first cycle, and as a rule also those of the second, perfect. Glandular streaks of the filaments very meandrian. The proximal parts of the mesenteries only slightly coalesced.

Ptychodactis patula Appellöf.

Pl. 3. Fig. 6.

Ptychodactis patula n. sp. Appellöf 1893 Pl. 1—3.
— — App. Carlgren 1914 p. 13.

Diagnosis: Body low, often disc-like, broader in the proximal end than in the distal one. Column and pedal disc in preserved state with circular ridges and furrows. Tentacles in 4—5 (to 6?) cycles, about 100—122, a little smaller in number than the mesenteries, distinctly longitudinally sulcated conical, short, with weak, ectodermal, longitudinal muscles. Oral disc with shallow, radial furrows and weak, radial muscles, actinopharynx with ectodermal, longitudinal muscles. Curled prolongations of the actinopharynx on the mesenteries of the first and of most of the second cycle. Pairs of mesenteries to about 72 (6 + 6 + 12 + 24 + one more or less complete fifth cycle). Parieto-basilar muscles and stomata absent. Spirocysts in the column and in the oral disc extremely rare, also in the tentacles not common. Nematocysts not especially numerous and small, in the column about 11—14 × 2—2,5 μ, in the tentacles from 10 × 2—2,5 μ to 19 × 3,5 μ and in the actinopharynx 12 × 2,5 μ to 19 × 3,5 μ.

Colour: Specimens living on Primnoa yellow with salmond-red filaments, those on Muricea blue (Nordgaard).

Dimensions: Proximal part of the animal to about 7,5 cm broad. Length of the tentacles 1—1,5 cm (Appellöf). Specimen from the Ingolf-Exp. (compare below).

Occurrence: Norway. Drontheimfiord 100 fms. on Muricea placomus and on Primnoa lepadifera (Nordgaard, G. O. Sars)

N. of Iceland, 66°3′ N. 20°05′ W. 44 fms. Temperature at the bottom 5,6° (Ingolf-Exp. St. 127) 1 sp.

The anatomical description of the species given by Appellöf I have further completed in 1914 and, among other things, I have pointed out the presence of the curious, half-funnel-like formations on the imperfect mesenteries. I now want to add something to this, especially with regard to the actinopharynx. The specimen dredged by the Ingolf-Expedition is much smaller than the specimens described by Appellöf, has produced only few reproductive elements and is very contracted. The diameter of the pedal disc was 2 cm, the height of the column 1 cm and the breadth at the distal end about 1 cm, the greatest length of the tentacles 1,2 cm. The tentacles were only 40 in number. The outer habitus of this specimen agrees very well with the description which Appellöf gives of the species, and very much resembles the specimen reproduced in fig. 1 in the paper by Appellöf, though the body is a little higher (Pl. 3. fig. 6) and the mouth is almost closed and sourrounded by a wall rising above the other part of the oral disc. From the upper rim of this wall (opening of the mouth?) to the lower end of the actinopharynx the distance is 0,35—0,45 cm (in reality the distance is a little greater, as the undermost part of the actinopharynx is bent outward). The whole thing looks as if the actinopharynx is much longer than stated by Appellöf. As however no distinct limit exists between the oral disc and the actinopharynx — the ectodermal radial muscles and the radial furrows on the oral disc are prolongated as longitudinal muscles resp. longitudinal furrows into the actinopharynx (a factum already emphasized by Appellöf) and the occurrence and the size of the stinging capsules are the same in both regions — it is almost impossible to decide, where the actinopharynx begins. If we are of the same opinion as Appellöf and regards the actinopharynx as reduced to a thin joint, the animal has the capability — as the Ingolf-specimen shows — of turning down the central parts of the oral disc, so that they look like the actinopharynx, and "the mouth" is not on the rim of the actinopharynx, but completely surrounded by the oral disc. If in opposition to this we consider that the actinopharynx begins at the "mouth", the actinopharynx is nowise as much reduced as Appellöf assures, though on such a supposition certainly short. I therefore hold it best to modify a little the diagnosis of the genus concerning the length of the actinopharynx. Furthermore the actinopharynx of the Ingolf-specimen shows the same appearance as that of the specimen described by Appellöf, the prolongations of the actinopharynx on the mesenteries are however not as strongly folded in the former. Concerning the inner organisation I cannot give any information of the arrangement of the mesenteries as I have not found it desirable to totally sectionise the specimen. The half-funnel-shaped formations on the imperfect mesenteries agree in their structure with those described by me before (1914). The glandular streaks were very meandrian, and the slightly developed reproductive organs were limited to the lower parts of the mesenteries under the glandular streaks. The longitudinal muscles of the column were distinct, though they do not seem to form a continuous lamella. The spirocysts of the tentacles were rare and about 14—17 × 2,5 μ in size, those of the column and of the oral disc very uncommon — after much searching in the maceration-preparations I found only one spirocyst in the column and one pair in the oral disc. Also the nematocysts are not particularly numerous and, like the spirocysts, they are of inconsiderable size, in the column 11—14 × 2,5 μ, in the tentacles 10 × 2—2,5 μ to 19 × 3,5 μ and in the actinopharynx 12 × 2,5 μ to 19 × 3,5 —4,5 μ. The spiral thread is often discernible in the greater nematocysts of the tentacles and of the actinopharynx. I have examined the stinging capsules as well in one of the type-specimens as in the Ingolf-specimen.

Family *Halcuriidae (Endocoelactiidae)*.

Diagnosis: Protactininae with pedal disc not well defined from the column. The ectoderm of the column as well as that of the actinopharynx with spirocysts, (spirocysts sometimes absent: in the column of *Halcurias endocoelactis*, teste Stephenson). Longitudinal muscles as a rule absent in the column (in *Halcurias pilatus* present, teste Mc. Murrich). No sphincter. Tentacles arranged either in two alternating cycles or in several such, very much displaced (18 + 10 + 16 + 8 + 16) and not arranged as in the typical Actiniaria. Longitudinal muscles of the tentacles ectodermal, radial muscles of the oral disc ectodermal or with a little tendency to be mesogloeal (meso-ectodermal). Actinopharynx strong with 1—2 siphonoglyphes. Mesenteries from the second cycle developed in the endocoels — each pair of mesenteries with the longitudinal muscles facing away from each other — and arranged either cyclically, or, from the 20(—28) mesentery-stage, bilaterally in 8 or in a few more development-zones. In the latter case each bilateral pair consists of a micro and a macro-mesenterium (or of two equally developed mesenteries?). Longitudinal muscles of the mesenteries mostly weak, sometimes forming pennons. All stronger mesenteries with reproductive organs.

In this family I (1918) have included the genera *Halcurias* Mc. Murr. (= *Endocoelactis* Carlgr.), *Synhalcurias* Carlgr., *Synactinernus* Carlgr., *Isactinernus* Carlgr. and *Actinernus* Verr. (= *Porponia* R. Hertw.). Compare this paper. To these genera Stephenson (1918b) adds a new genus, *Carlgrenia* which evidently is much related to *Halcurias* and possibly might be referred to this genus. Concerning the species *Halcurias endocoelactis*, described by Stephenson (1918a), it is questionable if this species really is an *Halcurias*. The in certain respects incomplete description of the species, given by Stephenson, founded on his examination of a single specimen, seems to me to indicate that we have to do with a distinct genus. The arrangement of the mesenteries is not the typical *Halcurias*-distribution, but seems to be more irregular as in *Synhalcurias*. Probably the development of the later mesenteries resembles that in *Actinernus* and is also bilateral. It is, however, not quite identical as it looks as if the new mesenteries develop more unilaterally, in so much as the development-zones seem to be found on both sides of the 4 mesenteries of the second cycle. Judging from the description by Stephenson it forms a transition between the *Halcurias*- and the *Actinernus*-types. Also the absence of the spirocysts in the column, if not overlooked by Stephenson, — (S. has examined the column only on sections and not on maceration-preparations which give the only certain criterium if the spirocysts are very rare or absent) — speaks for the opinion that this species may form the type of a new genus, because all other known Halcuriidae have spirocysts in their column-ectoderm. I propose for this new genus the name *Halcuriopsis* and give here a preliminary diagnosis based on the description by Stephenson:

Elongated Halcuriidae, not distally lobated. Column smooth without papillae and spirocysts. Tentacles short, conical, without thickenings of the mesogloea at the outer side of the base, comparatively few. Arrangement? Longitudinal muscles of the tentacles ectodermal, not strong. Only one siphonoglyphe. Mesenteries comparatively few, the older with strong muscle-pennons, to the stage of 20 mesenteries developed as in Halcurias, from this stage new mesenteries originate, probably in only 8 development-zones on both sides of the 4 mesenteries of the second cycle. Both mesenteries of the same pair equivalent.

Genus **Actinernus** Verr.

Diagnosis: Halcuriidae with thick cylindrical body, in the distal part more or less increasing in breadth and often forming distinct lobes commonly 8 in number. Sometimes these lobes are only indicated or wanting in young individuals. Tentacles of ordinary length, conical or cylindrical, excepting the youngest (and in *A. elongatus* also the inner ones?) cannot be covered by the column; on the outer side with very thick mesogloea which continues bridgelike in the mesogloea of the column. The arrangement of the tentacles more or less distinct, not frequently like that of *Halcurias*. For the greater part the tentacles are concentrated in two cycles with the largest tentacles in the apex of the lobes. Oral disc wide, especially where distinct lobes are present, more narrow between the lobes, with weak, radial ridges and shallow furrows between. Actinopharynx well developed with rather numerous, deep, longitudinal furrows and 2 broad siphonoglyphes, to which several mesenteries are attached. Mesenteries numerous, arranged in the beginning as the older mesenteries of *Halcurias*, after the stage of 20 mesenteries or a little later the mesenteries originate bilaterally, in 8 or some more development-zones, situated between the distal lobes. The development of the mesenteries goes on mostly from the edges of the endocoels towards their middle. The bilateral pairs consisting each of one micro- and one macro-mesenterium. Dioecious.

Actinernus nobilis Verr.

Actinernus nobilis n. sp. Verrill 1879 p. 474.
— — Verr. Verrill 1885 p. 534 fig. 23, Andres 1883 p. 584.
Carlgren 1914 p. 70. 1818 p. 32 textfigs. 8—10, 25.

Diagnosis: Body cup-like, short, toward the distal part forming 4 greater and 4 smaller, alternate lobes. The lobes sometimes (often?) show a tendency to divide into feeble, indistinct, secondary lobes. Mesogloea-bridges on the outer side of the tentacles broad, somewhat depressed from without inwards, teeth-like, rather short and sharp-pointed in the apex. Distal parts of the tentacles of normal appearance, conical, in the summit pointed, not sulcated, or feebly lengthwise so. Arrangements of the tentacles indistinct, at least in two cycles. Number of tentacles to about 120. The thick-walled nematocysts in the ectoderm of the pedal disc 25—31 (36) × 2,5 μ, those of the column 24—38 × 2—2,5 (3) μ, those of the tentacles partly 38—61 × 2,5—4 μ, partly 22—29 × 2 μ, those of the actinopharynx 34—41 × 2,5 μ. Spirocysts in the column commonly 31—48 × 5 μ, sometimes larger, those in the tentacles of variable size, the largest up to 67 × 7 μ, those in the actinopharynx about as those in the tentacles. Arrangement of the mesenteries bilateral after the stage of 20—28 mesenteries. Longitudinal muscles of the tentacles comparatively weak, radial muscles of the oral disc somewhat stronger, both of these ectodermal. Longitudinal muscles of the mesenteries not strong, form no distinct pennons. Parieto-basilar muscles weak.

Colour: In recently preserved state: oral disc and tentacles deep purplish brown, with radiating lines of paler colour on the oral disc, mouth (actinopharynx) deep brown inside, sides of body milk-white with traces of orange-colour where the outer coat remains (Verrill).

Dimensions: Up to 10 cm broad and 7,5 cm high in preserved state (Verrill).

Occurrence: Davis Strait 63°30'N. 54°24' W. 582 fms. Temperature at the bottom 3,3° (Ingolf-Exp. St. 25).

Further distribution: North-Atlantic. Northern part of U. S. A. from deep water rare, common at Nova Scotia from a depth of 200—300 fathoms (Verrill).

This species I have described in detail in 1918, wherefore I now only give a diagnosis of the same.

Subtribus Nynactininae.

Athenaria s. Abasilaria.

The group Athenaria (Carlgren 1898), or more distinctly termed Abasilaria (Carlgren 1905), differs from the more differentiated Actiniaria, Thenaria or Basilaria, through the character that the basilar muscles are wanting in the former, present in the latter, and includes almost all the old groups, Actinines pivotantes, proposed by Milne-Edwards 1857, and the family Ilyanthidae established by Gosse 1858, excepting the genera which afterwards proved to belong to quite different Anthozoa, such as *Sphenopus*, *Arachnactis* and *Cerianthus*. I am of opinion that in the system of Gosse 1858 we also find no less than four families of Athenaria represented, the Edwardsiidae by the genus *Edwardsia*, the Halcampidae by *Halcampa*, the Halcampoididae by *Peachia* and the Ilyanthidae by *Ilyanthus*. Besides these families I include in the group the families Limnactiniidae n. fam., Andwakiidae and Halcampactiidae which certainly would have been referred to the Actinines pivotantes or Ilyanthidae, if they had been known at the time of the formation of these groups. The diagnoses which different authors have given of these groups are namely such that they in reality almost correspond with the character of the group which I have called Athenaria. Thus Milne-Edwards characterizes his Actinines pivotantes as follows. "Espèces dont le pied est très petit et le corps fort allongé", and Gosse his family Ilyanthidae in the following manner. "Corporis extremitas inferior obtuse rotundata sine basi adhaerente ....". Other authors, having used the group to about the same extent, give the following diagnosis of it. "Column elongated, tapering below to a pointed or rounded base, without a distinct disc .... (Verrill 1864)", "Actinianae liberae basi musculari carentes" (Andres 1880), "Körper verlängert wurm- oder säulenförmig, hinten zugespitzt, nicht scheibenartig verbreitet und daher nicht festheftend, nur in Sand vergraben" (Klunzinger 1877), "Hexactinien mit abgerundetem aboralen Körperende ohne Fussscheibe" (R. Hertwig 1882). Thus the absence of a real pedal disc is the main character which these authors have given the Actinines pivotantes or Ilyanthidae, the same character which distinguishes the Athenaria, still with the difference that the absence of the basilar muscles is the principal character, while the shape of the proximal body-end, if pointed, rounded or flattened disc-shaped, is of little importance as pointed out by me (1905 p. 517), though it is true that most Athenaria commonly show a rounded-proximal body-end. This part is namely in certain species able to alter its shape, f. inst. *Milne-Edwardsia loveni* alters the shape of its proximal end in accordance with the variation of the canals in the dead Lophohelia-stocks, and the commonly rounded or a little flattened proximal end of *Milne-Edwardsia carnea* is capable of flattening out disc-like, so that it gets a considerable breadth, at the same time as the body becomes low and conical what I have observed in a specimen, the cuticle of which was dropped in the aquarium (Compare *Milne-edwardsia carnea*). *Halianthella* (= *Marsupifer*) has the same capability. A specimen of this latter, taken by the German deep-sea expedition was namely almost cake-like and reminded of a very contracted Thenaria with a real pedal disc (with basilar muscles). The aboral, flattened end was attached to a stone. Under such circumstances there is nothing at all to prevent referring to the Athenaria such a genus as *Octineon* which is devoid of basilar muscles, and the proximal body-end of which forms a wide, basal plate incrusted with sand.

The absence of basilar muscles is common to the Athenaria, Protactininae and Protostichodactylinae (Corallimorphidae, Discosomidae, Carlgren 1900).

My suggestion to divide the Actininae into two groups, Athenaria and Thenaria, has been opposed by Mc. Murrich and Poche. Mc. Murrich (1904 p. 221) declares that this division in Athenaria and Thenaria "tends to the confusion of unrelated forms and the separation of others which are nearly related", an idea which I showed (1905 p. 517) to have no foundation whatever, in as much as I pointed out that the opinion of Mc. Murrich that the basilar muscles of the Thenaria are homologous with the parietal muscles of the Athenaria, on which he mainly supports his statement, is false. At the same time I reject the supposition of Mc. Murrich that *Haloclava* and *Eloactis* would be Thenarians. Mc. Murrich prefers to divide the Actiniaria at once in families "recognizing in addition to the Edwardsiidae, which will include in addition to the Edwardsiae and Halcampidae (Auct.) the genus *Scytophorus*, the Gonactiniidae, which will include *Gonactinia*, *Protanthea* and possibly *Oractis*, the Peachiidae, including *Peachia* and *Haloclava* and the Ilyanthidae having essentially the limitations recognised by Andres (1883)." On further examination we find, however, that the enumerated forms are devoid of basilar muscles, while all other genera, described in the paper of Mc. Murrich 1904, are Thenarians. In the system of Pax (1914), which is for a great part based on my works, he begins by placing among Nynantheae the same families as I myself (1900 p. 24), and gives as first character "ohne Fussscheibe und Basilarmuskeln", while he continues by enumerating families which are mainly characterised by the presence of a well-developed pedal disc, (an exception being made by the free-swimming Minyadidae which belongs to the Stichodactylinae, owing to my examination (1914).

Under such circumstances it seems difficult to me to understand that it would be wrong, from a classificatory point of view, to comprehend all families without basilar muscles in a large unity and all with basilar muscles in another. The absence of the basilar muscles is namely, as shown by me, a primitive character occurring only in lower Actiniaria, and moreover it is characteristic of the Zoantharia (s. str.) and Madreporaria, the Anthozoa, to which the Actiniaria are most nearly related. In those groups there is no real pedal disc but rather a basal plate of exactly the same nature as in *Protanthea* and *Octineon*. Thus as we find that several families are devoid of basilar muscles, while others have such, and as furthermore this lacking of basilar muscles is a primitive character which they have in common with Zoantharia and Madreporaria, the basilar muscles appearing only in the more differentiated Actiniaria, I cannot see that there is any ostensible reason against dividing the Nynactininae into Athenaria and Thenaria (Abasilaria and Basilaria). It would, of course, be different, if it was to be proved that forms without as well as with basilar muscles appeared in one family. In a single case genera without, and some with basilar muscles have in fact been referred to one family, namely the Aliciidae. In my opinion such a classification is not well founded, and the family is heterogeneous, as I have already stated (1900 p. 96) and will further discuss later on. The objection by Poche (1914 p. 96) that circumstances in the family Aliciidae prove the groups Athenaria—Thenaria to be untenable, is invalid. His other objection to my classification is no better; he namely writes: "Die Einwendungen Mc. Murrich's gegen die Unterscheidungen der Abteilungen Athenaria und Thenaria, die im Wesentlichen auf das Fehlen bezw. Vorhandensein der Basilarmuskeln gegründet ist, hat Carlgren allerdings zum Teil in befriedigender Weise widerlegt. So wird man seiner Bekämpfung der von Mc. Murrich behaupteten Homologien der Basilar- mit den Parietalmuskeln gewiss beistimmen, ebenso seiner Zurückweisung des auf Haloclava und Eloactis gegründeten Einwandes. Unwiderlegt bleibt aber der Einwurf betreffs der nahen Zusammenstellung von Edwardsia und Halcampa einerseits, mit Ilyanthus andererseits." As far as I understand, Mc. Murrich in his paper (1904 p. 221) does not make any manifest objection especially to the placing of *Ilyanthus* near the Edwardsiidae, and even if he does object, I do not see his reason for it, *Ilyanthus* being no more a Thenarian than *Haloclava* and *Eloactis*, but really an Athenarian. The occurrence of a rather well-developed, endodermal sphincter in *Ilyanthus*, in contradistinction to the weak, endodermal muscles in *Edwardsia* forming no sphincter, does not speak against the classification proposed by myself. The nature of the sphincter is namely at most a family character. Mc. Murrich wrongly refers *Halcampa* with its mesogloeal sphincter to the Edwardsiidae, and *Oractis* which is provided with a well-developed endodermal sphincter, together with the sphincter-lacking *Protanthea* and *Gonactinia* to the Gonactiniidae.

If thus the establishment of the groups of Athenaria and Thenaria is well founded, it remains to make clear the extent of the different families which would have to be placed in the former group. The classification of the Actiniaria, lacking a pedal disc, varies considerably according to the different authors, in as much as some of them discern only one, others few or several families. The previous authors, such as Milne-Edwards (1857), Gosse (1858), Hincks (1861), Verrill (1864, 1868), Klunzinger (1877), Studer (1879), Andres (1880) place all genera — those afterwards discovered I of course leave out of consideration — together in a single section or family Actinines pivotantes sc. Ilyanthidae. A later author, Faurot (1895) also uses the former term. Only in 1880 Andres distinguishes the Edwardsiidae as a separate family which is accepted by Haddon (1889); 1882 and 1888 R. Hertwig however attributes a greater systematic importance to this family, in as much as he establishes a tribus for the genus *Edwardsia* which is accepted among others by Mc. Murrich (1893) and Carlgren (1893); the latter divides the tribus into two families Edwardsidae and Milne-Edwardsidae. 1898 Carlgren again assigns to the tribus a lower systematical rank which it has later on generally kept. Mc. Murrich (1904 p. 232) even enlarges it, by placing in it not only the *Edwardsia* but also *Scytophorus* and Halcampidae (Auct.), and Delage and Hérouard (1904) place in their subordo Edwardsina both the Edwardsinae and the Protantheinae (*Gonactinia*, *Protanthea* and *Oractis*).

Disregarding the Edwardsiidae we find the other genera belonging to my Athenaria — I leave out of consideration some genera which have been placed in another family, such as *Oractis* — arranged in a single family Ilyanthidae with the subfamilies Halcampinae, Halcampomorphinae and Andwakianae in the paper of Carlgren (1893) and in that of Haddon (1897) — in the latter paper there are, however, only two subfamilies, Halcampinae and Halianthinae, while R. Hertwig 1888 divides them into two families, Ilyanthidae and Siphonactinidae. Haddon (1889), however, places both *Halcampa* and *Peachia* (=*Siphonactinia*) in the family Halcampidae. In the work of Andres (1883) our Athenaria, except the Edwardsidae, is represented by four families, Halcampidae, Siphonactinidae, Mesacmeidae and Ilyanthidae, a division also used by Pennington (1885). — the Mesacmaeidae are, however, not mentioned here. Mc. Murrich (1893) distinguishes 3 families, Halcampidae, Ilyanthidae and Siphonactinidae, but some years later (1904) only 2, Ilyanthidae and Peachiidae (= Siphonactinidae), while the Halcampids are placed with the Edwardsiidae. 1900 Carlgren divides the Athenaria, excepting the Edwardsiidae, in five families, Halcampomorphidae, Halcampidae, Halcampactidae, Andwakiadae and Ilyanthidae, an arrangement which Pax accepts (1914 p. 609), though he, as well as other authors, does not make use of the term Athenaria. In a paper by Poche (1914) we find almost the same families, Peachiidae, Halcampidae, Halcampactiniidae, Andwakiidae and Ilyanthidae; in the former the genera are, however, grouped in another way than in the systems of Carlgren and Pax. Stephenson recently (1918) uses the Ilyanthidae as originally defined, excepting, however, the Edwardsiidae.

A curious division we find in the works of Delage and Hérouard (1901), who regard the Edwardsina and Halcampina as suborders equivalent to the Actinina and Stichodactylina. The first group includes among others the family Edwardsinae, the second the families Halcampinae and Monaulinae, which latter Hertwig (1882) refers to a separate tribus Monauleae, while the Ilyanthinae and the Mesacmaeinae are placed in the third group.

From which point of view shall we classify my Athenaria viz. mainly the old groups Actinines pivotantes sc. Ilyanthidae (s. lat.)? That it is necessary to separate the genera provided with acontia, from the other genera, hardly needs further discussion, and would not likely be denied by any recent author. As some Athenaria provided with acontia lack a sphincter, while others have a distinct mesogloeal one, it may be practical to divide them into two families, Halcampactiidae (Halcampactiniidae) and Andwakiidae, in the same way as we separate the two families Actiniidae and Paractiidae of the Thenaria, on account of the nature of the sphincter. Unfortunately only Pax and Poche have clearly stated their view concerning this question and adopted my opinion. On the other hand, it is necessary further to discuss the arrangement of the forms without acontia. Are the Edwardsids to be placed together with the Halcampids, as proposed by Mc. Murrich; are the Siphonactinids = Peachiidae to form a particular family; are the Halcampids (s. lat.) with mesogloeal sphincter, and those lacking one, to be united in a single family; and finally, is a particular family to be established for the genus *Ilyanthus*? Concerning the first question, which is closely connected with the third, I must at any rate positively refuse the attempt to place the Edwardsids together with forms provided with a mesogloeal sphincter, viz. the Halcampids (s. str.). The only principal point of view for the arrangement of the other Athenaria is namely, in my opinion, the structure of the sphincter and its occurrence. Most of these forms are devoid of sphincter, some have a mesogloeal and a few a rather well-developed, endodermal one. Why should we not apply this feature as a basis of classification in this case, when in the more differentiated Actiniaria with basilar muscles we lay so much stress, and with full right, on the appearance of the sphincter as a basis for the arrangement of the families? We distinguish the family Actiniidae from the Paractiidae mainly by the structure of the sphincter, in as much as the sphincter is lacking or endodermal in the first family, but mesogloeal in the second. If for instance the genus *Paractis* should turn out to be provided with an endodermal sphincter instead of a mesogloeal one, it would no doubt by all authors be referred to the family Actiniidae. As we cannot suppose that the mesogloeal sphincter is developed in another way in the Athenaria than in the more differentiated Actiniaria — I at least cannot find anything tending to prove that the mesogloeal sphincter of the Halcampids variates, so as to make it now endodermal, now mesogloeal, with transitory stages between[1]; in the genera *Halcampa*, *Parahalcampa* and *Cactosoma* the sphincter is mesogloeal and conspicuous, in *Halianthella* strong and even double — it seems most consistent to me to separate the acontia-lacking Athenaria, provided with a mesogloeal sphincter from the other forms, and to place them in a separate family, Halcampidae. Thus I cannot adopt the classification neither of Mc. Murrich nor of Poche, who do not see any reason in the character of the sphincter for the formation of a family Halcampidae, based on the occurrence of a mesogloeal sphincter. Besides, how inconsistent Poche is in keeping the family Ilyanthidae, based on the occurrence of a diffus-circumscript endodermal sphincter, while he separates the two with acontia provided families, Andwakiidae and Halcampactiniidae, though the only difference between these latter consists in the former having a mesogloeal sphincter, the latter none. The family Halcampidae, based on the presence of a mesogloeal sphincter, must therefore be maintained.

Concerning the family Ilyanthidae s. str., it might possibly be placed together with some of the remaining forms (the family Halcampoididae), as forms with an endodermal sphincter are rather to be referred to forms with no sphincter. I do, however, think that it is more practical to keep this family.

To the family Peachiidae (Siphonactiniidae) the genera *Peachia*, *Eloactis* and *Haloclava* are referred. The characters on which the family might be based are as follows: 1) the bilateral arrangement of the 20

[1] According to several authors the genus *Aiptasia* has no sphincter or is provided with now an endodermal, now a mesogloeal one. For the species with a mesogloeal sphincter Stephenson (1918 p. 51) has proposed a special genus *Aiptasioides* with the species *prima* and *pallida* which he refers to the subfamily Metridinae. Though I have no particular knowledge of these genera, I would be inclined to go still further and place the genus *Aiptasia* in a special family Aiptasiidae. The whole family Sagartiidae besides needs a radical revision, some species of *Phellia* probably belong to the Andwakiidae.

Since this paper was written, Stephenson in a paper (1920 Quart. Journ. Mic. Sc. 64) has divided the Sagartians into several families. I agree with him that the Sagartians are not a homogeneous group, and with Bourne (Quart. Journ. Mic. Sc. 63, 1919) that they are of different origin. In the second part of this work I will further discuss this question.

mesenteries (the checked development of the dorsolateral mesenteries of the second cycle) 2) the presence of a single, well-developed siphonoglyphe and 3) the arrangement of the tentacles: the inner endocoel-tentacles are shorter than the outer exocoel-tentacles (compare Carlgren 1904 p. 544). There is no doubt that the above-named genera are nearly related to each other, but it is a question, if these genera alone ought to be placed in a particular family. Leaving *Oractis* out of consideration, the position of which I will further discuss later on, we find a bilateral symmetry, though of a somewhat different type in the Edwardsids, in *Pentactinia* — where the number of mesenteries is the same as in *Peachia*, but the ventrolateral mesenteries of the second order not developed, while in *Peachia* the corresponding, dorsolateral mesenteries are missing, in *Parahalcampa* and *Limnactinia*, and at last probably also in *Siphonactinopsis*, the mesenteries of which are twice as many as in *Peachia*. A single, ventral siphonoglyphe is also present on most, perhaps all Edwardsids, though it is only a little differentiated, furthermore in *Pentactinia*, *Harenactis*, *Mesacmaea*, *Scytophorus* and *Parahalcampa*. The same arrangement of the tentacles as in *Peachia* we observe in several Edwardsids, namely in the subfamily Edwardsiinae, while in the Milne-edwardsiinae and the other genera the inner tentacles are longer than the outer ones, or all tentacles of about the same length. Only the arrangement of the mesenteries is thus specifically characteristic of *Peachia*, *Haloclava* and *Eloactis*, in as much as there are 10 pairs of mesenteries, while the dorsolateral mesenteries of the second order are missing, an arrangement which possibly they have in common with *Siphonactinopsis*, though there are twice as many in the latter. However much the arrangement of the mesenteries varies in the Athenaria I will call the attention to the fact that *Scytophorus* has only 14 mesenteries, and therefore I do not think it justifiable to establish a separate family for *Peachia*, *Eloactis* and *Haloclava* on account of the number and position of the mesenteries. The maintaining of the family Monaulidae and the establishing of several families owing to the arrangement of the mesenteries are the logical consequences of these facts.

If we keep to the arrangement of the tentacles, it would be much more justifiable to place the subfamily Edwardsiinae together with *Peachia*, *Haloclava* and *Eloactis* in a family Edwardsiidae, and the subfamily Milne-edwardsiinae together with the other acontia- and sphincter-lacking Athenaria in another one. As it is, however, possible that this conformity in the arrangement of the tentacles in the Edwardsiinae *Peachia*, etc. may depend on a convergence[1], caused by their having parasitic larvae (observed among the genus *Edwardsia* and *Peachia*), I provisionally place the subfamilies Edwardsiinae and Milne-edwardsiinae as before in a single family, Edwardsiidae, while the other acontia- and sphincter-lacking Athenaria are referred to a family which I call Halcampoididae after *Halcampoides*, the most primitive genus. (Halcampoididae, proposed as a subfamily by Appellöf (1896), is synonymous with my family Halcampomorphidae which must be dropped, according to the international rules). Thus I provisionally refer to the Athenaria the same families as in 1900, only adding the new family Limnactiniidae, and with the difference that the name Halcampomorphidae is exchanged for Halcampoididae. Consequently the arrangement of the genera in the different families is as follows:

[1] I seize the opportunity to rectify an error, slipped in while my paper (1900 b) was being printed. Page 544, the first note has "nicht wahrscheinlich" for, in my manuscript "recht wahrscheinlich."

Fam. Edwardsiidae	Subfam. Edwardsiinae .... Genera.	*Edwardsia* Quatr.
		Isoedwardsia Carlgr.
	Subfam. Milne-edwardsiinae... Genera.	*Milne-edwardsia* Carlgr.
		Paraedwardsia Carlgr.
Fam. Halcampoididae	Genera.	*Halcampoides* Dan., *Acthelmis* Lütk., *Phytocoetes*[2] Ann., *Halcampella* Andr., *Synhalcampella*[1] Carlgr., *Scytophorus* R. Hertw., *Pentactinia* Carlgr., *Harenactis* Torr., *Siphonactinopsis* Carlgr. *Mesacmaea* Andr., *Peachia* Gosse, *Eloactis* Andr., *Haloclava* Verr., *?Polyopis* R. Hertw.
Fam. Limnactiniidae	Genera.	*Limnactinia* Carlgr., *?Polyopis* R. Hertw.
Fam. Halcampidae.	Genera.	*Halcampa* Gosse, *Parahalcampa* Carlgr., *Synhalcampa*[2] Carlgr., *Cactosoma* Dan., *Mena*[2] Steph., *Halianthella* Kwietn.
Fam. Halcampactiidae.	Genera.	*Halcampactis* Farquh., *Haliactis* Carlgr., *Pelocoetes* Ann.[2], *?Ilyactis* Andr., *?Octophellia* Andr.
Fam. Andwakiidae.	Genera.	*Andwakia* Dan., *Octineon* Mosel, *?Ilyactis* Andr., *?Octophellia* Andr.
Fam. Ilyanthidae.	Genera.	*Ilyanthus* Forb., *Oractis* Mc. Murr.

In the following I will further discuss the position of the genera within the families of which I have mentioned the first six here. Concerning the position of the genus *Oractis* I am a little doubtful. It is true that, according to me, it cannot be placed in the family Gonactiniidae, as proposed by Mc. Murrich, because it is only in the arrangement of the mesenteries that it partly agrees with this family, while it differs essentially from it in the other characters. The only families which are to be considered in the placing of this genus are the Halcampoididae and the Ilyanthidae. The endodermal sphincter which is, in proportion to the small

[1] Compare the family Halcampoididae.

[2] Since this was written Stephenson (1920 p. 520) has proposed a new family provided with acontia, Diadumenidae, enclosing *Diadumene* Ann, *Pelocoetes* Ann., *Phytocoetes* Ann., and *Mena* Steph. The family is certainly heterogeneous. The type-genus differs in several respects from the three others. The former has a well-developed pedal disc and certainly belongs to the Basilaria, while the three latter probably are Abasilaria. (It is probably a lapsus of Annandale when he (1915 p. 81) speaks of basilar muscles instead of parietal muscles). In consequence of Annandale's description of their structure it seems to me that *Pelocoetes* would belong to the Halcampactiidae, *Phytocoetes* and *Mena* to the Andwakiidae. But on further examination of Annandale's figure 3 (p. 80) in which the acontia are also represented, I think that at least *Phytocoetes gangicus* is not provided with acontia. The figure designated as acontia is namely no such thing, but simply mesenterial filaments. Thus *Phytocoetes* is a Halcampoid and nearly related to *Acthelmis*. Concerning *Mena* (*Phytocoetes*) *chilkaea* I am of opinion that this species is a *Cactosoma*. Nothing in the structure speaks against it; on the contrary the appearance of the sphincter and the presence of papillae on the column indicate that we have to do with this genus. At least it is closely related to this genus. Finally *Pelocoetes* is a good genus and probably belonging to the Halcampactiidae. Though Annandale has not given any figure of the acontia, but says that they are long and relatively stout, it is probable that in this case he has not mistaken the mesenterial filaments for acontia.

The species *Halianthus limnicola* Ann. is, though a Halcampid, probably the type of a new genus. It is neither a *Halcampa* nor a *Cactosoma*. The absence of secondary, imperfect mesenteries in the whole length or almost so of the column and the presence of 12 rows of tubercles on the column, serve to distinguish it from the two genera. Besides, it differs from *Halcampa* in having sometimes more than 12 tentacles, but in this respect it agrees with *Cactosoma*. The presence of extra-tentacles indicates that there are weak mesenteries in the uppermost part of the column as in *Halcampella* of the Halcampoididae. As *Halianthus* is a synonym of *Halcampa* I propose a new name for it *Synhalcampa*, characterized as follows:

Halcampidae with no external differentiation of capitulum, scapus and physa. Aboral extremity provided with a porus. Column with 12 longitudinal rows of solid tubercles, towards the aboral end obsolete. Sphincter weak, close below the base of the tentacles. Tentacles 12 or some more, short, but stout and cylindrical. Two rather well-developed siphonoglyphes and 2 pairs of directives. Six pairs of perfect mesenteries with rather strong pennons. When the tentacles are more than 12, some very weak mesenteries are probably found in the uppermost part of the column. Excepting these, no imperfect mesenteries.

size of the animal, very strong, seems to indicate that we have to do with an Ilyanthid. In another paper I will give a more complete description of the genus than that given by Mc. Murrich.

The new genus *Parahalcampa* from the Antarctic, of which I cannot give a full description here, I characterize as follows:

Halcampidae with elongated body. Column not divisible into regions, without cuticle and "Halcampapapillae". Proximal end physa-shaped, penetrated by apertures. The most distal part of the column with spirocysts. Sphincter as in Halcampa. Tentacles 10, thick and short. A single weak siphonoglyphe. Number of mesenteries 10 + 10. The 10 first (the "Edwardsia-mesenteries" + the fifth couple) perfect, fertile and with strong, longitudinal pennons and filaments. The 10 others (the sixth couple + the dorsolateral and lateral mesenteries of the second order) imperfect, sterile, weak, without longitudinal pennons and filaments, in the whole length of the body. Type *P. antarctica* n. sp.

Family *Edwardsiidae*.

Diagnosis: Athenaria with elongated body, divisible into two or commonly into three regions, without sphincter or acontia. Tentacles always present. 8 perfect and fertile mesenteries. Two opposite pairs, the longitudinal muscles of each turning away from each other, forming the two directive pairs of mesenteries, and between these on each side 2 mesenteries with the longitudinal pennons turning towards the ventral directive. Four to several weak and very short mesenteries in the uppermost part of the column, always without filaments and reproductive organs. Ciliated streaks always present, sometimes discontinuous.

Owing to the presence or absence of nemathybomes (Nesselhöckerkapseln) and to the occurrence of two different types in the arrangement of the tentacles I have (1900) divided this family into two subfamilies, Edwardsiinae and Milne-edwardsiinae, corresponding to my families Edwardsiidae and Milne-edwardsiidae (1893) — a division which I will provisionally keep, though it is possibly a question, if it would not be more correct to place the Edwardsiinae together with *Peachia*, *Haloclava* and *Eloactis* in a family, and the Milne-edwardsiinae together with the family Halcampoididae (compare above p. 20).

To the former subfamily the genera *Edwardsia* (incl. *Edwardsiella* and *Edwardsioides*) and *Isoedwardsia* belong, to the latter *Milne-edwardsia* and *Paraedwardsia*.

The generally very elongated body-wall is divisible into two or three regions, as it is often the case in the Athenaria. The most distal part, capitulum, is always present, but comparatively short. It is devoid of a cuticle and provided with 8 longitudinal furrows, corresponding to the insertions of the mesenteries. These furrows are more or less distinct, the most conspicuous in the genus *Milne-edwardsia*, especially in *M. carnea* and still more in *M. loveni*, in which the capitulum has a decidedly polygonal appearance. The other part of the column is formed either wholly by the scapus, provided with a cuticle, or by a more or less developed physa, commonly ampullaceous and devoid of cuticle, added to the most aboral part of the column.

The physa is the most distinct in the genus *Edwardsia*, while in the genera *Milne-edwardsia* and *Paraedwardsia* it is either lacking or not well-developed. In the genus *Isoedwardsia* there is never any physa, but the most aboral part shows the same structure as the scapus. Transverse sections through the most aboral part of the body-wall in *Edwardsia* therefore differ in appearance from those of *Isoedwardsia*. In *Edwardsia* we find in this region a thick ectoderm without cuticle (textfigs. 6, 62) and with scattered nematocysts; in *Isoedwardsia* commonly, (but not always) a thin ectoderm, always provided with cuticle, and the nematocysts enclosed in the nemathybomes (textfig. 69, compare below), The physa of the genus *Edwardsia is* probably always perforated by apertures. It is true that I have not examined all the specimens of *Edwardsia*, described here, in that respect, but as I have observed apertures in the physa of all the species (*E. andresi, vegae, arctica, finmarchica, vitrea, longicornis*), the aboral end of which I have thoroughly examined, it may not be precipitate to attribute such apertures to all *Edwardsia*-species. To judge from the structure of the wall

Fig. 6.

Fig. 7.

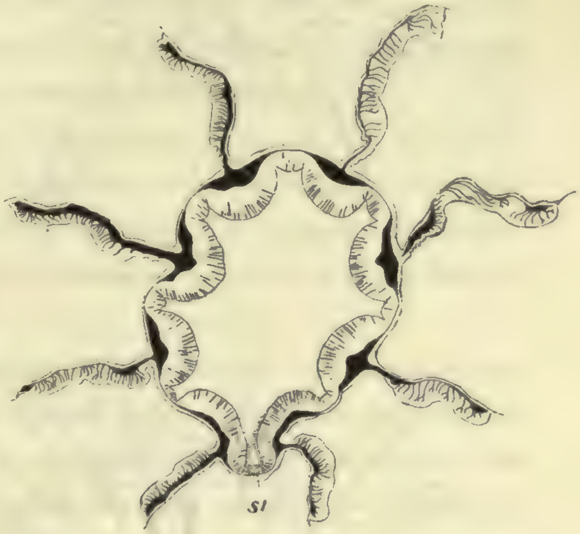


Fig. 8.

Textfig. 6. Longitudinal section of the proximal part of the body of *Edwardsia andresi* *ne*: nemathybomes, *me*: mesentery. The ectoderm of the physa is partly lost. — Textfig. 7. Transverse section of the upper part of the actinopharynx with parts of the mesenteries of *Edwardsia claparedii*. — Textfig. 8. A similar section in the lower part. *si*: siphonoglyphe.

of the apertures of *E. vegae* it seems as if the apertures are invaginations of the ectoderm. The apertures are surrounded by a circular thickening, possibly of the ectoderm and forming a movable stopping which is directed outwards (textfigs. 50, 51) or inwards (textfig. 62), according to the different state of contraction of the physa. The endodermal muscles form a circular sphincter round the apertures. The other Edwardsiidae are probably devoid of aperture in the proximal end; I will, however, remark that I have not examined the proximal part of the column as thoroughly as in the genus *Edwardsia*.

The scapus is provided with a weaker or stronger cuticle or periderm. In *Isoedwardsia ingolfi* and *Milne-edwardsia loveni* I have found the strongest cuticle. In the genus *Paraedwardsia* there are "Halcampa-papillae", which are wanting in the other genera. Concerning the structure of these papillae I refer to the genus *Halcampa*. The nematocysts of the scapus-ectoderm in the four genera show a different arrangement and are of a very different size, in comparison with the nematocysts of the capitulum. In the simplest case the nematocysts of the scapus are scattered as in *Paraedwardsia*, now placed mainly on the ridges as in *Milne-edwardsia loveni*, now for the greater part collected in larger or smaller clusters as in *Milne-edwardsia carnea, polaris* and *nathorstii*. Sometimes these clusters are arranged in shallow invaginations of the mesogloea as

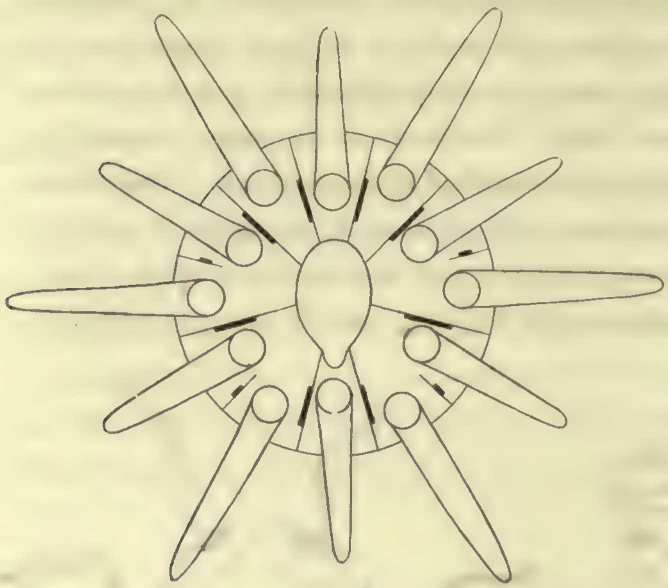


Fig. 9.

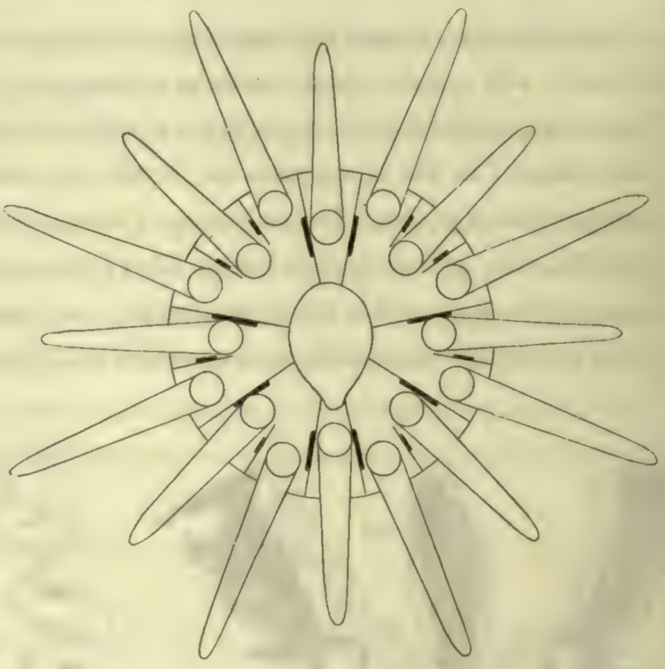


Fig. 10.

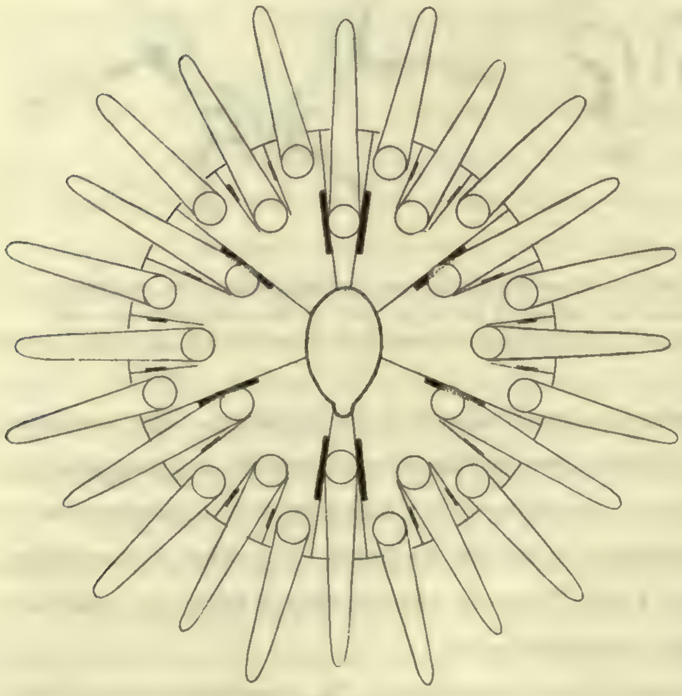


Fig. 11.

Textfigs. 9—11. Arrangement of tentacles and mesenteries in *Edwardsia andresi* (fig. 9), *E. claparedii* (fig. 10) and *Milne-edwardsia loveni* and *carnea* (fig. 11). In order to show the arrangement in pairs, the imperfect mesenteries are drawn as having pennons. In fact that is not the case.

in *Milne-edwardsia polaris*. These clusters form weak batteries of nematocysts. In the genus *Edwardsia* and *Isoedwardsia* the nematocysts of the scapus are more concentrated and enclosed in so-called nemathybomes, forming strong batteries of stinging capsules. The nemathybomes are now arranged in 8 longitudinal rows as in *E. tuberculata*, *claparedii* and *longicornis*, now irregularly scattered as in *E. vitrea*, *finmarchica*, *sipunculoides*, *intermedia* and others. Possibly there are more than 8 longitudinal rows in some species. The nemathybomes appear the most distinctly in the species with 8 rows. Here they are fewer in number, but commonly larger and form conspicuous tubercles on the scapus; on the other hand, if the nemathybomes are scattered they are smaller, but more numerous and projecting a little or not at all over the surface of the scapus, according as the contraction of the animal is strong or weak. The nemathybomes form a capsule in the mesogloea and are filled with more or less numerous nematocysts and their mother-cells. The walls of the nemathybomes are formed by the mesogloea which is only perforated in the apex of the nemathybomes. Here the scapus-ectoderm is in connection with the nemathybomes, and through the aperture the nematocysts eject their stinging threads. The nemathybomes are to be conceived as stinging batteries invaginated in the mesogloea. Also the size of the scapus-nematocysts, in comparison with that of the nematocysts of the capitular ectoderm, seems to depend on, whether the nematocysts are arranged in nemathybomes or not. In the genera provided with nemathybomes, *Edwardsia* and *Isoedwardsia*, the nematocysts of the nemythybomes are narrow and long and commonly several times as long as the small nematocysts of the capitulum. In the sub-family, Milne-edwardsiinae, on the other hand, the nematocysts of the scapus are more short and broad and hardly larger than the nematocysts of the capitular ectoderm, which are generally considerably larger here than in the sub-family Edwardsiinae. Especially in *Milne-edwardsia loveni* and *carnea* there are numerous nematocysts on the capitular ridges (textfigs. 75, 79). The ectoderm of the column probably never contai ns any spirocysts, nor is it provided with longitudinal muscles; sometimes there is a well-developed nerve-layer in the ectoderm of the capitulum (in *Edwardsia andresi* and *Paraedwardsia sarsii*). The mesogloea contains a few cells and are more or less thickened; on the capitulum it forms the main part of the ridges, when any such appear (as in *Milne-edwardsia loveni* and *M. carnea*). The endodermal, circular muscles are more or less developed, but never concentrated to a sphincter; they here and there break through the mesenteries, as always in the Actiniaria, and are thus in these places enclosed in the mesogloea. In *Milne-edwardsia nathorstii* and *Paraedwardsia sarsii* nematocysts occur in the endoderm.

The tentacles are short, in sexually ripe individuals probably never less than 12. As I have already pointed out in a previous paper the tentacles are arranged in two different ways (compare Carlgren 1893; 1904). The first type, observed in different *Edwardsia*-species and in *Isoedwardsia mediterranean*, and probably characteristic of these genera, we may call the *Edwardsia*-type (textfigs. 9, 10). It is characterized by its inner tentacles, off-shoots from the endocoels, being shorter than the outer tentacles, — an arrangement which we find again in some Halcampoididae, viz. in *Peachia*, *Eloactis* and *Haloclava*. On the other side, in the second type, the *Milne-edwardsia*-type (textfig. 11) the inner tentacles are longer than the outer ones, as it is commonly the case in the Actininae. Representatives of this type we meet in the genera *Milne-edwardsia* and *Paraedwardsia*. This type is probably characteristic of these genera, as I have found such an arrangement[1] in all cases where I have been able to undertake a thorough examination of them. The ectoderm of the

[1] Bourne (1916, Journ. Linn. Soc. 32 Zool. p. 513) has given an account of the order of succession of the micro-mesenteries and tentacles in the Edwardsiae. I think that in many respects his statements are erroneous. *Edwardsia duodecimcirrata* (*E. Lütkenii*) is no *Edwardsia* but a *Halcampa duodecimcirrata* (compare Carlgren 1893 p. 38). The parasitic larva of *Halcampa*, described by Haddon, is the larva of *Peachia* (Carlgren 1904. Zool. Anzeiger 27 p. 536). The arrangement of the tentacles and the mesenteries in *E. claparedii* is that typical of the *Edwardsia* with 16 tentacles (compare the scheme and Carlgren 1904 l. c. p. 543) and the grouping of the mesenteries evidently identical with that described by Bourne in *E. beautempsii* and *willeyana*. (Andres has confounded the dorsal and the ventral side in *E. claparedii*; in my paper (1893 a) I supposed that Andres's statement of the tentacular arrangement was correct). Unfortunately the order of succession of the tentacles in the *Edwardsia* is not known in details in any species, but we are obliged to construct it from different stages of different *Edwardsia*-species, a proceeding which always leads to a more or less uncertain result. In doing this we are in the first instance to study the tentacles of live specimens and, if necessary, to supply our observations with sections. As, however, the inner tentacles of the genus *Edwardsia* s. str. are (always?) shorter than the outer ones, as in *Peachia*, *Eloactis* and *Haloclava*, it is probable that the tentacles 9—12 are developed on a biradial plan (Carlgren 1904 l. c., a paper overlooked by Bourne), while in the genus *Milne-edwardsia* the tentacles are arranged after the number 6 with the inner tentacles longer than the outer ones and the first 12 tentacles probably developing on a bilateral plan. (Carlgren 1893 textfig. 3, 4, 1893 b, textfig., 1904 p. 534). That the tentacles of *E. claparedii*, *M. loveni* and *carnea* are arranged in such a manner as here stated by me (textfigs. 9—11) is a fact that I have controlled several times in living specimens and in sections. In living *E. claparedii* it is easily seen that the directive tentacles belong to the inner, shorter tentacles which are often bending towards the mouth. The parts of the oral disc lying over the directive chamb-

tentacles contains nematocysts as well as spirocysts. The longitudinal muscles of the tentacles are always ectodermal as are also the radial muscles of the oral disc. The actinopharynx is longitudinally sulcated. In no case I have observed any dorsal siphonoglyphe; on the other hand, I have in representatives of all four genera found a ventral siphonoglyphe, a little developed. It it distinguishable from the other furrows of the actinopharynx through its cells being provided with longer cilia than those of the other part of the actinopharynx (Textfig. 7, 8). The ectoderm of the actinopharynx contains nematocysts, sometimes of two kinds.

The mesenteries are partly perfect, provided with reproductive organs, longitudinal pennons and filaments, partly imperfect without such organs, and only present in the uppermost part of the column. The former, "the *Edwardsia*-mesenteries", are arranged as the diagnosis indicates. There are thus 2 pairs of directive mesenteries and 2 couples of lateral mesenteries, the latter forming pairs with 4 imperfect mesenteries (textfig. 9). In the simplest case there are only 4 imperfect mesenteries developed, belonging to the first order, as in *E. andresi* (textfig. 9). In most species a more or less imperfect cycle of the second order is added, and sometimes one of the third order. The longitudinal muscles of the perfect mesenteries always form pennons with more or less numerous folds. The pennons are always distinctly distinguishable from the other part of the mesenteries, but seem never to be circumscript in the sense that the inner and outer lamellar parts of the mesenteries issue from one point of the fold or very close by each other.

The outer lamellar part of the mesenteries is in the reproductive tract attached to the pennon near its outer edge or somewhat nearer to the middle of it. At the insertions of the mesenteries on the column the perfect mesenteries have developed the so-called parietal muscles; one part of these is placed at the same side as the pennons and is only a differentiation of the longitudinal muscles, the second part, arranged at the opposite side of the mesenteries, is homologous with the parietobasilar muscles in the more differentiated Actiniaria (Carlgren 1905). The parietal muscles also show a different appearance in several species, commonly extending, and as a rule without folding, over a smaller or greater part of the column, whereby the contraction of the body in longitudinal direction is facilitated. In exceptional cases, as in *Milne-edwardsia nathorstii*, these column-muscles are comparatively strong and form rather high folds (textfig. 85). Towards the aboral end of the body the longitudinal pennons taper more and more and end by fusing with the outer

ers are namely of another colour than the other part of the disc. Bourne supposes that the development of the micro-mesenteries in the Edwardsids is another than in the other Actiniaria and will not regard the mesenteries 9—12 and the other micro-mesenteries as homologous with those on the Actiniaria. In comparing the mesenteries as homologous with those of for instance *Halcampa* (Carlgren 1893 a textfig. 6. 1 a) I cannot find any difference. The arrangement of the mesenteries in *E. claparedii* and in other *Edwardsia* having 16 tentacles agrees for instance with that in *Gonactinia* and in a young specimen of *Sagartia* (*Cylista*) *undata* (Carlgren 1893 a p. 99). Bourne's statement that the micro-mesenteries in *Edwardsia* arise in couples of singles, and not in couples of pairs as in the Actiniaria, certainly needs a more extensive examination before it can be accepted. I think that the development of the tentacles is mainly the same in the Edwardsids and in the other Actininae. As namely, by the appearance of a new pair of mesenteries in the Actiniaria, the new tentacles, one endocoel- and one exocoel-tentacle, do not arise quite simultaneously, and as the foundation of the mesenteries agrees with that of the tentacles, it is clear that in certain stages of development we must find single mesenteries instead of pairs. (Compare Bourne's statement Quart. Journ. Mic. Sc. 63 1919) concerning the development of the mesenteries of *Phellia*. Also in the paper by Faurot (1905) in which he describes the development of the tentacles of *Ilyanthus*, we can in some figures see an indication of a different size of both mesenteries of the same pair (that this is not always the case is probably an inadvertency of Faurot, to whom the principal object has evidently been to investigate the order of appearance of the tentacles and not that of the mesenteries). Besides this, it ought to be remarked that in several Actiniaria (in the Actinostolids, in some Halcuriidae as in *Actinernus* and others) a great difference in both mesenteries, belonging to a pair, exists. Thus Bourne's suggestion that the Edwardsiae should form a special group of the Anthozoa, different from the Actiniaria, is, according to me, not well founded.

part of the mesenteries viz. with the parietal muscles. Thus the mesenteries are provided with a continuous, longitudinal muscle layer at the aboral end of the body. The ciliated streaks are always present. The statement of Andres (1880) that they are lacking in *Edwardsia claparedii*, I cannot confirm, as they were present in the specimens I have examined. In *Isoedwardsia*, at least certainly in *I. mediterranea*, the ciliated streaks are discontinuous viz. scattered in several portions along the middle streak. A similar arrangement we find in *Limnactinia laevis*, *Scytophorus antarcticus* and *Parahalcampa antarctica*. As far as up till now is known, all Edwardsiids are dioecious. Only the 8 "*Edwardsia*-mesenteries" are provided with filaments and reproductive organs.

A classification of the Edwardsiidae, especially of the species of the genus *Edwardsia*, is rather difficult. The different size of the nematocysts however forms quite a good character, and so do also, though in a smaller degree, the structure of the muscle pennons and that of the parietal muscles. In order to get good points of comparison the sections of the muscle pennons and the parietal muscles have been taken, when possible, in the upper part of the reproductive region. Sections through different tracts of the body are namely of a very different appearance in the same species. In order to decide whether the structure of the pennons and the parietal muscles is practicable as a valuable species-character I have often reproduced figures of both kinds, belonging to species from different localities.

Sub-family Edwardsiinae.

Diagnosis. Edwardsiidae with the physa well-developed or wanting. Scapus provided with nemathybomes. Nematocysts of the capitulum, in comparison with those of the nemathybomes, small. Inner tentacles, endocoel-tentacles, shorter than the outer ones.

The genera *Edwardsia* Quatr. and *Isoedwardsia* Carlgr. belong to this subfamily.

Genus **Edwardsia** Quatref.

Diagnosis. Edwardsiidae with body-wall divisible into three regions; physa, scapus and capitulum. Physa always present, without nemathybomes. Scapus with a more or less developed periderm (cuticle) with nemathybomes containing nematocysts in a rounded cavity in the mesogloea. Nematocysts in the nemathybomes long, in proportion to the breadth. Nemathybomes in 8 longitudinal lines, or more or less irregularly scattered, now distinctly conspicuous upon the scapus-surface, now on a level with it. Nematocysts in the ectoderm of the cuticle-lacking capitulum small. Tentacles 12—16 or in several cycles, the inner shorter than the outer (always?). Actinopharynx with a single, feebly developed, ventral siphonoglyphe (always?).

To the genus *Edwardsia* I have here referred the genera *Edwardsia*, *Edwardsiella* and *Edwardsioides*. The establishment of the last genus is not justified, because, according to my examination of the type-specimen, it is not different from a typical *Edwardsia* (*Edwardsiella*). On the other hand it it questionable, if the genus *Edwardsiella* ought to be maintained. The genus is proposed by Andres (1883) for the Edwardsiidae having more than 16 tentacles. Concerning the number of the tentacles I think that it is of no great importance as a genus-character, because the number varies very much in several species. The arrangement of the nemathybomes, on the other hand, may — as before pointed out by me (1898, 1900) — be used with more success for the distinction of both genera; in the genus *Edwardsia* the nemathybomes are arranged in 8 longitudinal rows, in *Edwardsiella* they are more scattered. As it is on several occasions very difficult to determine the arrangement of the nemathybomes in preserved and often strongly contracted material, a strong contraction causing several displacements in their relative position, it is, however, for practical reasons and in order to avoid confusion, the most reasonable to place together *Edwardsia* and *Edwardsiella* in a single genus *Edwardsia*.

I give below a synopsis of the Arctic and Northern *Edwardsia*-species, examined by myself.

Synopsis of the Edwardsia-species described here.

		Number of tentacles	Nematocysts of the nemathybomes		Nematocysts of the actinopharynx		
A. Nematocysts of the nemathybomes of 2 different sizes. (The larger nematocysts very sparse in **danica**).							
a) 8 distinct longitudinal lines of comparatively few, but large nemathybomes	**tuberculata**	16	60—96 × 2,5 μ	(72) 110—190 × (4) 5—7 μ	....	22—37 × 2,5 μ	27—34 × 5—6 μ
	longicornis	16 (very seldom 12?)	36—65 × 2 (2,5)	36—86 × 3,5—4,5 (5)	14—17 × 2 μ	25—29 × 2,5—3	26—30 × 7
aa) Nemathybomes very numerous and close, mostly arranged in groups..............	**pallida**	16	36—53 × 2,5	62—74 × 5	22 × 1,5—26 × 2	29—36 × 2,5	....
aaa) Nemathybomes not very numerous, scattered. The large nematocysts sometimes wanting? ...	**danica**	(12) 14—20	24—43 × (2,5) 3—3,5 (4)	46—72 × 4,5	15—19 × 1—2	24—34 × 2—2,5	....
AA. Nematocysts of the nemathybomes of only one size.							
α) 8 longitudinal lines of nemathybomes (possibly in the proximal part a little scattered). Pennons with few (12—13) folds..............	**arctica**	16	38—60 × 4—5		....	29—41 × 3—3,5	26—34 × 4—6
αα) Nemathybomes arranged in 16 longitudinal lines?	**fusca**	12	31—36 × 2—2,5		....	36—46 × 2,5—3	....
ααα) Nemathybomes arranged in the middle line between the insertions of the mesenteries, but not forming any distinct longitudinal lines....	**andresi**	12 seldom 13—15	48—67 × 3,5—4		....	(29) 36—43 (46) × 3—3,5	24—29 × 4—5
αααα) Nematocysts scattered.							
b) Longitudinal pennons with few (to about 15) folds.							
c) Cuticle very well developed. Parietal muscles strong..............	**islandica**	16	36—48 × 2—2,5		....	(33) 36—43 × 2	....
cc) Cuticle? Scapus-ectoderm incrusted. Parietal muscles ordinarily developed	**incerta**	12? not more than 16	29—37 × 5		....	....	....
bb) Longitudinal pennons well-developed with about 20—30 folds.							
d) Parietal muscles with very numerous folds..............	**vitrea**	13—16	36—42 × 3—3,5		17—29 × 2,5—3,5	36—53 × 3—3,5	....
dd) Parietal muscles comparatively weak.	**vegae**	16	84—101 × 3		....	38—43 × 3	....
bbb) Longitudinal pennons strong with about 50 folds. Parietal muscles comparatively weak..............	**finmarchica**	16—26 (or more?)	(26) 36—48 (60) × 3—3,5 (4)		....	30—35 × 2,5—3	....

Edwardsia tuberculata Düb. and Koren.

Pl. 1. Fig. 20.

Edwardsia tuberculata n. sp. Düben and Koren 1847 p. 267.

— — Düb. & Kor., Koren 1857 p. 93. Sars 1861 p. 262.

O. & R. Hertwig 1879 Pl. 1. figs. 2, 6.

— *clavata* Rathke p. p. Andres 1883 p. 308. Carlgren 1893 a p. 12. Appellöf 1895 p. 7. 11 Grieg 1897 p. 12.

— ? — Rathke. Appellöf 1891 p. 12 figs. 10—11.

Diagnosis. Physa well-developed. Scapus with a rather well-developed periderm and 8 distinct lines of large, rather few nemathybomes. Nematocysts of the nemathybomes partly 60—96 × 2.5 μ, partly (72) 110—190 × (4) 5—7 μ. Nematocysts of the capitulum 11—13 × 1.5 μ. Tentacles 16. Nematocysts of the tentacles 18—26 × about 1.5 μ, their spirocysts 14—22 × 2.5 μ. Nematocysts of the actinopharynx partly typical 22—37 × 2.5 μ, partly with discernible basal part to the spiral thread 27—34 × 5—6 μ. Longitudinal muscle-pennons strong, in transverse sections elongated, in the upper part of the reproductive region with about 30 lower and higher, sparse, often dichotomously ramificated folds. Outer folds, in proportion to the inner ones, only slightly branched. Outer lamellar part of the mesenteries in the reproductive region attached to the pennon rather close to the centre. Parietal muscles strong, with numerous folds (15—20 or more on each side), high, rather perpendicularly issuing and a little branched. The extension of the parietal muscles on the column very inconsiderable.

Colour. Scapus commonly brown.

Dimensions in strongly contracted state with the physa involved unto about 2 cm long and 0.7 cm broad.

Occurrence: Norway. Bergen (Koren, Appellöf) Bergen, Manger 15 fms. (Sars) Bergen Herlö fiord 6—12 fms. (teste Appellöf), Molde (teste Sars), Utne fiord 100 fms. (Bowallius 1882), Vaags fiord, Skavö-Tomberviken 40—80 fms. (teste Grieg), Halnaesviken (teste Grieg), Drontheim fiord Rödberg 150—200 m (Östergren 1891) Norway without distinct locality (Lütken).

Sweden. Koster fiord N. Hellsö 100—150 fms. (C. Auriwillius 1895), Sneholmen (C. Auriwillius 1895), Väderöarne 60—80 fms. (1911).

Denmark. Cattegat (Petersen).

S. of Iceland 63°15′ N. 22°23′ W. 326—216 m (Thor-Exp. St. 161).

Exterior aspect: The physa is well-developed, but commonly involved. The scapus is provided with a rather strong cuticle. The large but few nemathybomes are arranged in 8 distinct, longitudinal lines and appear very distinctly as papilliform off-shoots on the scapus. The scapus, as well as the capitulum, are polygonal, at least in the contracted state of the animal. The tentacles are 16, cylindrical, in contracted state rather thick. The actinopharynx is longitudinally sulcated.

Anatomical description: This species has before been anatomically examined by O. and R.

Hertwig (1879) and by Appellöf (1891), but in several respects imperfectly. Neither is my description as perfect as desirable, the material not always having been well preserved.

The ectoderm of the scapus is considerably thinner than the mesogloea. The nematocysts of the nemathybomes are numerous and of two kinds, both long, but one much more thin than the other. The longer and broader ones are a little thicker at the basal end, gradually tapering towards the distal end. In these latter the basal part to the spiral thread is commonly discernible.

The size of the nematocysts (n) and the spirocysts (sp.) in the different parts of the body is seen on the following table.

Habitat	physa	nemathybomes		tentacles		capitulum	actinopharynx	
	n.	n.	n.	n.	sp.	n.	n(a)	n(b)
1) Bergen Manger	—	74-96 × 2.5 μ	110-190 × 6-7 μ	19-26 × 1.5 μ	14-20 μ	11-13 × 1.5 μ	29-34 × 2.5 μ	—
2) Bergen (Koren).......	11-13 μ	72-84 × 2.5	122-144 × 6	22-26 × 1.5	17-22 × 2.5	11-13 μ	29-36 × 2.5	—
3) Väderöarne...........	12-14 × 1.5	79-96 × 2.5	113-154 × 5-6	22-26 × 1.5	17-23 × 2.5	11-12 × 1	29-37 × 2.5	29-34 × 5-6 μ
4) Kosterfiord N. Hellsö .	12-16 × 1.5	77-84 × 2.5	130-180 × 5-6	18-24 × 1.5	-22 × 1.5	—	22-29	—
5) — Sneholmen	—	70-77 × 2.5	(108) 127-146 × 5-6	—	—	—	—	—
6) St. 161 (Thor)	—	70 × 2.5	115-130 × 6-7	—	—	—	—	—
7) Norway (Lütken)	—	60-72 × 2(2.5)	96-134 × 6	—	—	—	—	—
8) — —	—	60-70 × 2	72-110 × 4-5	—	—	—	—	—
9) Drontheimfiord	—	72-84 × 2	(86) 103-137 × 6-6	—	—	—	—	—

n(a) typical nematocysts, n(b) nematocysts with a conspicuous basal part to the spiral thread.

As we see, the size of the stinging capsules agrees in the different specimens. Only in the specimens 7 and 8 the nematocysts of the nemathybomes are shorter; these specimens were also about half as long (length 1.1 cm, breadth 0.3 cm) as the others. Also in the smaller specimens the larger nematocysts of the nemathybomes reach a length of more than 100 μ (compare *Edw. longicornis*). Whether the n(b)-capsules, which are broader in the basal end, are constant, I cannot decide, I have not observed any in the specimens 1 and 2. In the maceration preparations of the two "Thor"-specimens, the ectoderm of which was very badly preserved, I found only one smaller nematocyst and 8 larger in the fragments of the nemathybomes. There is, however, no doubt that these specimens are *E. tuberculata*, as the muscles of the mesenteries agree with those of the specimens from Norway.

The 8 "Edwardsia-mesenteries" have strong pennons. O. and R. Hertwig (1879) have given a reproduction of a mesentery in the reproductive region. Owing to the comparatively few muscle-folds of the pennon the mesentery has probably been sectioned in the lower part of this tract, or the section possibly belongs to a smaller specimen. The textfigure 12 shows a section of a pennon in the upper part of the reproductive region. The pennon is rather elongated, the highest folds as usual next to the outside. The about 30 folds are mostly high, the high folds often dichotomously branched. The most ramificated fold is as usual the outermost. The parietal muscles are very high, the folds for the greater part dichotomously branched and issuing almost perpendicularly from the thick, main lamella (textfig. 14). For comparison I have here also reproduced figures of a pennon (textfig. 13) and of a parietal muscle (textfig. 15), belonging to a young, not sexually ripe specimen. The folds of the muscles are here considerably fewer. The extension of the parietal muscles on the column is inconsiderable.

Remark. Andres (1883) and after him I myself (1893) have placed this species together with Rathke's *E. clavata*, on the supposition that the nemathybomes had been overlooked by Rathke. After having examined the Düben and Koren's species I think that it cannot be identical with *E. clavata*, because the nemathybomes in *E. tuberculata* are too large to be overlooked. In fact it is impossible to identify with certainty *Edwardsia clavata* with any here described species, as Rathke's description may be applied to several Scandinavian species. As no type-specimen of *E. clavata* is known, I think that *E. clavata* may be dropped. I have not had the opportunity to see the specimens from Molde nor those collected by Appellöf and by Grieg; probably most of these belong to *E. tuberculata*, at any rate the specimen reproduced by Appellöf (1891) indubitably belongs to this species. On the other hand it is questionable if the specimens, dredged in the Herlöfiord from shallow water (6—12 fathoms) really, are this species, as *E. tuberculata* seems to live in deeper water (compare the occurrence).

Fig. 12.

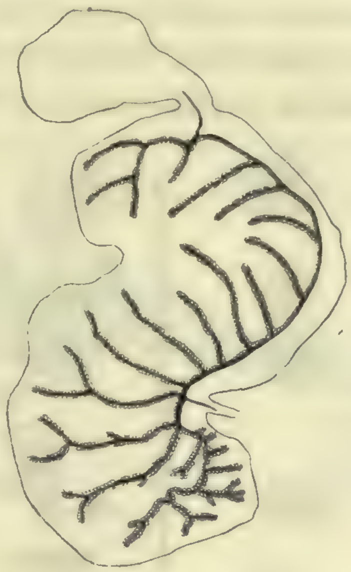


Fig. 13.

Textfigs. 12—15. *Edwardsia tuberculata.* Transverse sections of pennons (figs. 12, 13) and parietal muscles (figs. 14, 15) in the reproductive tract. Fig. 12 spec. from the museum of Christiania, fig. 14 spec. from the Cattegat (Petersen) and figs. 13, 15 young spec. from Utne fiord.

Fig. 14.

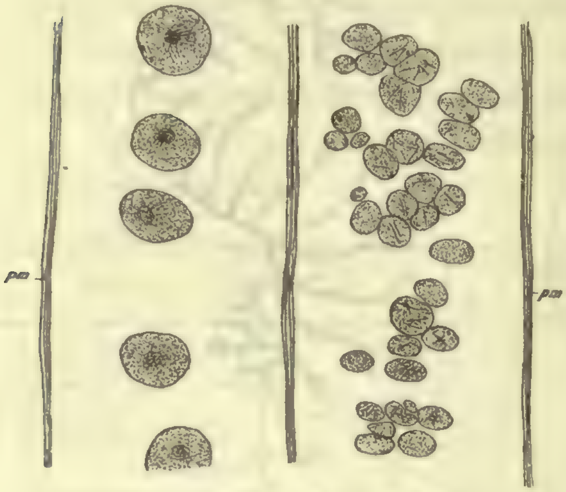
Fig. 15.

Edwardsia longicornis (n. sp.).

Edwardsia clavata var. *longicornis* n. var. Carlgren. 1893 a p. 12.

Diagnosis. Physa distinct. Scapus with a well-developed periderm and 8 lines of rather large but comparatively few nemathybomes. Nematocysts of the nemathybomes partly 36—65 × 2 (2.5 μ partly 36—86 × 3.5—4.5 (5) μ. Tentacles 16, very seldom 12?. Nematocysts of the tentacles 17—23 × 2 (2.5) μ, their spirocysts 14—17 μ long. Nematocysts of the actinopharynx partly typical, 14—17 × 2 μ and 25—29 × 2.5—3 μ, partly with discernible basal part to the spiral thread, broader in the basal end 26—30 × 7 μ.

Longitudinal muscle-pennons rather strong, in the upper part of the reproductive region with about 13—18 folds. Outer part of the pennons stronger than the inner one. The outer lamellar part of the mesenteries attached to the pennon rather close to the centre. Parietal muscle in the reproductive tract with few to rather numerous, thin and a little dichotomously branched folds, issuing from a rather thin, main lamella of the mesogloea. The extension of the parietal muscles on the column ordinary.



a Fig. 16. b

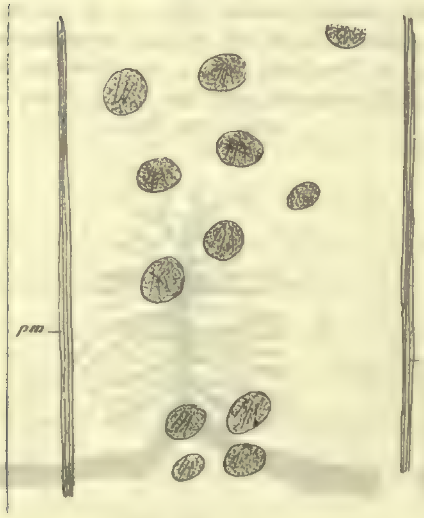


Fig. 17.

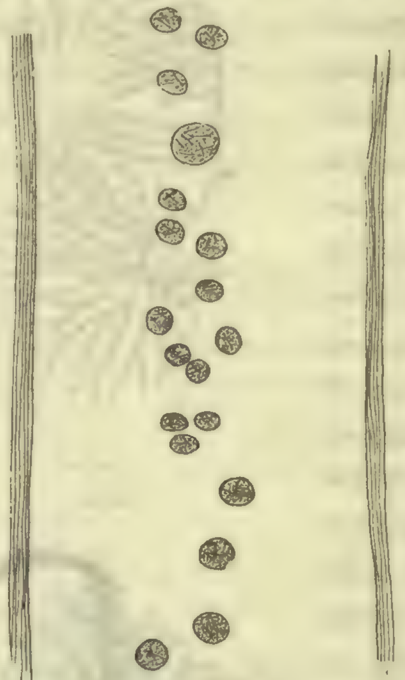


Fig. 18.

Textfigs. 16—18. Arrangement of the nemathybomes between two perfect mesenteries in *Edwardsia longicornis* (fig. 16*a*) in *E. pallida* (fig. 16*b*), in *E. danica* (fig. 17) and *E. andresi* (fig. 18). pm: parietal muscles. The figs. 16 and 18 are drawn in the same magnification, the fig. 17 is more magnified than the others. *E. longicornis* and *pallida* (from Bohuslän) and *E. andresi* (from Lyngen) were well expanded, *E. danica* (from Lille Baelt, Mortensen) was more contracted. The ectoderm in the preparations has been pencilled away.

Colour. Physa uncoloured. Scapus ochreous-yellow to orange or more dirtily-grey. Nemathybomes uncoloured. Capitulum now uncoloured, now paler or darker brownish-red, in the latter case with opaque white spots, with conspicuous insertions of the mesenteries. The spots are arranged in the middle-line and often confluent, forming indistinct, in the upper part broader, longitudinal lines, often terminating below the tentacles with a more clearly defined part. Tentacles uncoloured, with scattered, irregular, yellowish-white and reddish-brown spots. Oral disc yellowish-white shading off into ochre, with smaller white and larger brown spots and stripes.

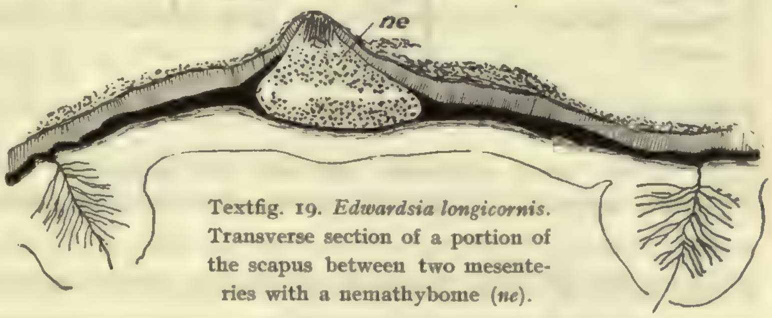
Dimensions in extended state: unto about 3 cm long and 0.3 cm broad.

Occurrence: Norway. Dröbak (Lütken).

Sweden. Bohuslän. Strömstad fiord (1882), Koster, Styrsö 10 fms. (Carlgren 1889), Bolthålan 20—25 fhs. (Hansson), Väderöarne 8—10 fms. (Carlgren, Östergren and others) very common, 15 fms. (Goës 1882), Varholmen (Carlgren), Gullmar fiord, Sämstad 8—10 fms. (Carlgren 1889) common, Zool. Stat. Kristineberg (1893), Gåsö "ränna" 8—10 fms. (Carlgren 1889—90), N. Gåsö fiord (Wirén 1890). Bohuslän without distinct locality (Lovén). Gothenburg Styrsö (Lagerberg).

Denmark. Samsöbelt (Winther), Cattegat without distinct locality (Petersen). The Sound S. of Hven 9 fms. (Gunhild Exp. 1878 st. 33), S. of Hven 17—26 m; W.N.W. of Wiken ("Sven Nilsson" st. 30, 52 c).

Exterior aspect. The physa is well-developed, the scapus provided with a thin periderm, with which is combined a rather thick and soft layer, commonly ochre-coloured and probably, at least partly, formed by closely-packed mucus-particles. The comparatively few, but rather large nemathybomes are arranged in 8 longitudinal lines as in *E. tuberculata* (textfigs. 16a, 19), quite another distribution than in *E. pallida* (textfig. 16 b). The nemathybomes are generally distinct, only if the animals are very contracted or the periderm is loosened from the ectoderm, it is sometimes difficult to discern them. Also in contracted specimens the nemathybomes keep in the main the same position, though they are often a little displaced and approached to each other. The upper part of the column at stronger contraction shows a polygonal appearance which is more distinct in extended specimens.



Textfig. 19. *Edwardsia longicornis.* Transverse section of a portion of the scapus between two mesenteries with a nemathybome (*ne*).

The tentacles are almost always 16, arranged in 2 cycles as in *E. claparedii* (compare textfig. 10); in a very small (0.4 × 0.15 cm), but fertile specimen from Samsö belt, sectioned by myself, I have not found more than 12 tentacles. Thus it looks as if the species could be ripe already in a stadium with 12 tentacles and with more than normally weak mesenterial muscles (compare below)[1], at least in the Danish seas, where the genus moreover does not reach the same size as in Bohuslän. Perhaps we here meet with the same case as in *Halcampa duodecimcirrata* which is ripe in a stadium with only 8 perfect mesenteries and 10 tentacles (Carlgren 1893 a), at least at our coast, where it is smaller than at the coast of Norway. The tentacles are conical and, in comparison with those of *E. pallida*, long (the name *longicornis*, however, does not indicate that the tentacles are longer than in the *Edwardsia*-species in common), the inner endocoel-tentacles are about two thirds as long as the outer exocoel-tentacles. The oral disc is conical and provided with radial furrows corresponding to the insertions of the mesenteries. The actinopharynx as usual is furnished with 8 longitudinal furrows, the ventral one of which forming a weak siphonoglyphe.

Anatomical description. The nematocysts of the nemathybomes are of two kinds, one shorter and thinner and of almost equal breadth, the other longer and broader and of different breadth at the basal and at the distal end, the latter the narrower. The size of the nematocysts and the spirocysts in the different parts of the body appears from the following table (see page 34).

The 8 "*Edwardsia*-mesenteries" are provided with well-developed, in transverse sections not elongated, longitudinal pennons. The highest folds appear as usual at the outside of the pennons, in the innermost part there is often also one high fold. The number of the folds in the upper part of the reproductive region

[1] It may be possible that we have to do with a distinct species here, but my material is too poor for deciding it. The parietal muscles of the Samsö specimen recall those of *E. danica*.

Habitat	nemathybomes n.	nemathybomes n.	capitulum n.	tentacles n.	tentacles sp.	actinopharynx n (a)	actinopharynx n (a)	actinopharynx n (b)
1) Väderöarne	58-62 × 2.5 μ	48-81 × 4-5 μ	—	19-23 × 2 μ	14-17 μ	14 × 2 μ	25-29 × 2.5-3 μ	30 × 7 μ
2) Kristineberg	53-65	48-86		—	—	—	—	—
3) Styrsö	41-58 × 2.5	41-72 × 4-5	—	17-22 × 2 (2.5)	14-17	14-17 × 2	—	26 × 7
4) Varholmen	43-61 × 2	46-67 × 3.5 (-5)	—	—	—	—	—	—
5) Dröbak	41-48 × 2	41-58 × 4 (5)	—	—	—	—	—	—
6) Bohuslän Zool. St.	48 × 2	48-65 × 3.5-4.5	—	—	—	—	—	—
7) Kattegat	36-50 × 2	36-61 × 3.5-4	—	—	—		—	—
8) —	about 46 × 2	38-53 × 3.5-4	—	—	—	—	—	—
9) Samsö Belt	43-55 × 2	43-65 × 3.5 (5)	—	—	—	—	—	—

n, n(a); typical nematocysts, spirocysts, n(b): nematocysts with discernible basal part to the spiral thread. The specimens provided with smaller nematocysts were small No. 8 (0.55 × 0.15 cm No. 9) 0.65 × 0.15 cm.

never exceeds 20; they variate in number; in several sectioned specimens I have found between 13 to 18 folds. I have reproduced the pennons from 3 different specimens in the textfigs. 20—22, of which textfig. 22

Fig. 20.

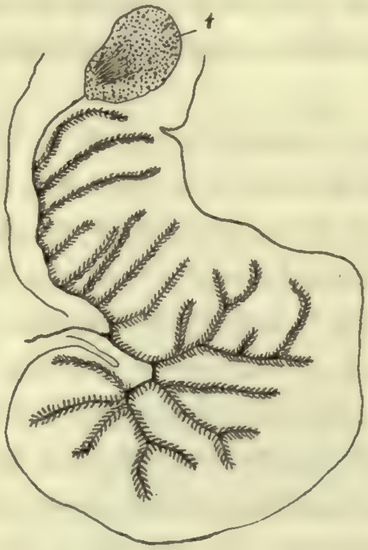


Fig. 21.

Fig. 22.

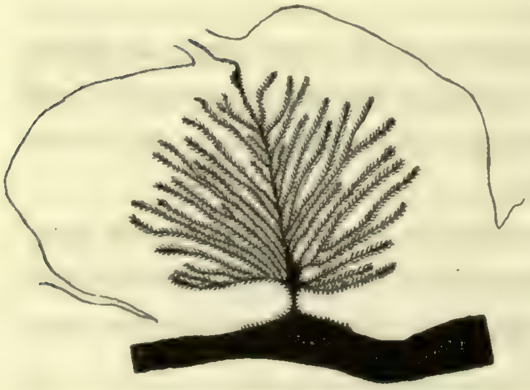


Fig. 23.

Textfigs. 20—24.
Edwardsia longicornis.
Transverse sections of pennons (figs. 20—22) and parietal muscles (figs. 23, 24) in the reproductive tract. Figs. 20, 21, 23 specimens from Bohuslän. Figs. 22, 24 specimen from Samsö Belt, compare the text!

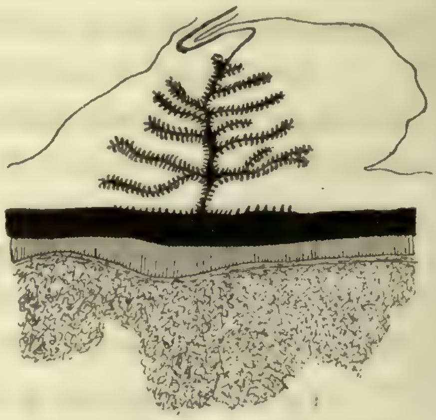


Fig. 24.

is taken from the sexually ripe Samsö-specimen with 12 tentacles. Though the number of folds variates in the different specimens the folds agree in appearance. The outer lamellar part of the mesenteries is attached to the pennon rather close to the centre. The weak, imperfect mesenteries in the uppermost part of the column are comparatively well-developed. The mesogloea off-shoots, supporting the parietal muscles, are often dichotomously branched and delicate, like the main lamella of the mesogloea. The folds of the parietal muscles vary considerably in number, as shown by the textfigures 24 of the Samsö-specimen and by a specimen from Bohuslän (textfig. 23) (compare note p. 33).

In larger specimens the parietal muscles appear similar to those of the textfigure 23. The expansion of the parietal muscles on the column is the ordinary one.

Remarks. This species is nearly allied to *E. tuberculata*, but is distinguished from this species by a more delicate form, by fewer folds of the muscles in the pennons, and above everything by smaller nematocysts of the nemathybomes. To this we might object that this difference in structure is due to a difference in age. As, however, the smallest specimens examined of *E. tuberculata* are smaller than the larger of *E. longicornis*, and as nevertheless the nematocysts of the two specimens differ very much in size, I must regard them as two different species. Besides this, *E. longicornis* seems to live in more shallow water than *E. tuberculata* which prefers deeper water. I have never found *E. longicornis* to reach the dimension of *E. tuberculata*, and yet I have a great material of the former for examination.

Edwardsia pallida (n. sp.).

Edwardsia clavata var. *pallida* n. var. Carlgren 1893 p. 12, 14 Pl. 2 figs. 5—9.

Diagnosis. Physa well-developed. Scapus with a thin periderm with irregular aggregates of nemathybomes. Nemathybomes in the aggregates mostly very closely packed. Nematocysts of the nemathybomes partly 36—53 × 2.5 μ, partly 62—74 × 5 μ, the latter often curved. Tentacles 16, now very short, cylindrical, not pointed, now longer and more conical. Nematocysts of the tentacles 17—19 × 1.5—(2) μ, their spirocysts 11—14 × 1—1.5 (2) μ. Nematocysts of the actinopharynx partly 22—26 × 1.5—2 μ, partly 29—36 × 2.5 μ. Longitudinal muscle-pennons rather strong, in the upper part of the reproductive region in transverse sections elongated with at most 20 (about 14—17) folds. Outer and inner part of the pennons comparatively richly branched with high folds, the middle part with simple or only slightly branched, short folds. The outer lamellar part of the mesenteries attached to the pennon not far from the outside. Parietal muscles in the reproductive region rather strong, with folds somewhat closely arranged, rather high and a little ramificated. Mesogloea in the parietal muscle-tract thickish. The expansion of the parietal muscles on the column is the ordinary one.

Colour. Physa uncoloured. Scapus mostly dirty-grey, sometimes ochreous-yellow, especially in the upper part. Capitulum uncoloured, transparent, its upper part sometimes yellowy-white with indistinct white lines on each side of the mesenterial insertions. Close to the tentacles a reddish-brown area is sometimes found, but it only seldom forms a continuous annulus as it is interrupted by the white lines. Tentacles uncoloured, transparent, with a brown streak at the base, at the inside of their apex a more or less distinct white spot and often another one at the base of the tentacles. Oral disc yellowy-white, with brown streaks around the mouth.

Dimensions in very extended state to about 6 cm. long, commonly shorter, breadth 0.3—0.4 cm.

Occurrence. Sweden. Bohuslän, Väderöarne 8—10 fms., sand (Carlgren, Oestergren) together with *E. longicornis*, but less frequent than this species. — 60 fms. (Gunhild-Exp. 1878).

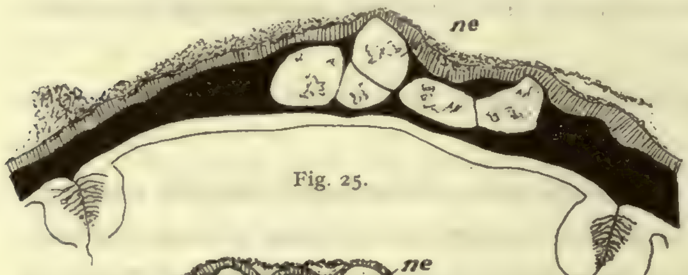


Fig. 25.

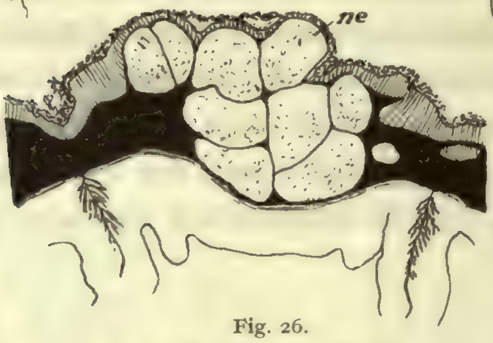


Fig. 26.

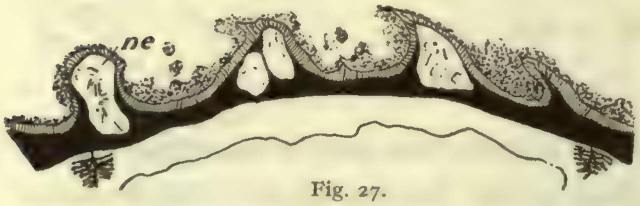


Fig. 27.

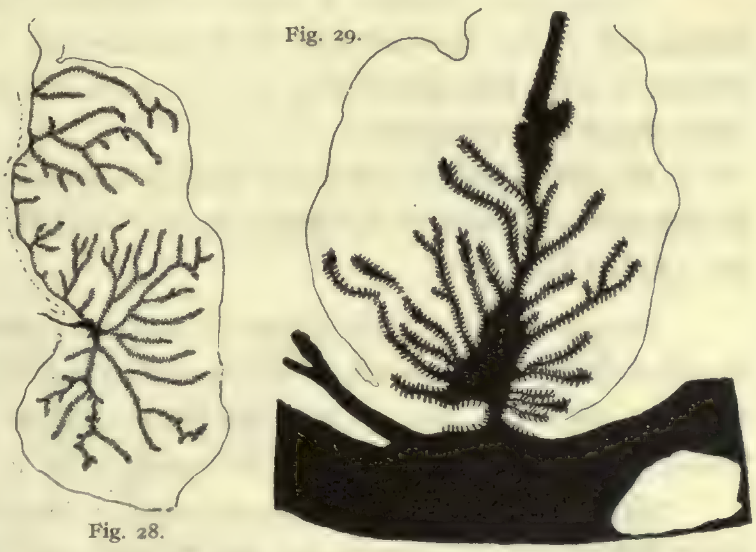
Textfigs. 25—27. Transverse sections of the scapus between two mesenteries of *Edwardsia pallida* (figs. 25, 26) and *Edwardsia danica* (fig. 27). ne: nemathybomes. Fig. 25 is drawn from an expanded specimen, fig. 26 from a contracted, fig. 27 from a rather much contracted specimen.

Exterior aspect. The physa is well-developed. The scapus is provided with a thin, slightly adherent periderm, commonly of a dirty-grey colour. The insertions of the mesenteries are conspicuous, apparently neither the scapus nor the capitulum are polygonal, at least not in extended state. The nemathybomes are not visible to the naked eye, wherefore the scapus seems to be devoid of them. They do, however, appear in great numbers and are mostly irregularly packed together in groups (textfigs. 16b, 25, 26, compare the anatomical description). The tentacles are 16 in number, now very short, cylindrical, not pointed, now conical and longer. The arrangement of the tentacles in two cycles is not as distinct here as in other *Edwardsia*-species, at any rate not when the tentacles are short. The oral disc and the actinopharynx are of usual appearance, the latter provided with 8 longitudinal furrows of which the ventral one is the broader and forms a weak siphonoglyphe.

Anatomical description. The nemathybomes of the scapus are comparatively small and usually collected in irregular groups; here and there a single nemathybome appears. In the aggregates the nemathybomes are very closely packed, separated from each other by a thin mesogloea-lamella. They therefore get an appearance as if they were composed of several nemathybome-capsules (textfigs. 25, 26 — Carlgren 1893 Pl. 2 fig. 9; in the reproduced figure in my paper 1893 it seems as if a single nemathybome is situated right opposite to the parietal muscle; the cavity is, however, an artificial product caused by the loosening of the ectoderm from the mesogloea.) Also in other *Edwardsia*-species with scattered, not regularly arranged nemathybomes, for instance in *E. vitrea, andresi, danica*, the nemathybomes may in transverse sections get an appearance recalling that of the nemathybomes in *E. pallida*, especially if the animals are contracted, in which case the nemathybomes are of course more close than when the scapus is extended. In no other species I have, however, observed nemathybomes as strongly agglomerated as in *E. pallida*. That the nemathybomes are in reality very close we may conclude from the textfigures 25 and 16b, the latter of which represents a piece of a compartment with the nemathybomes, seen from the surface, in a very extended specimen. In contracted animals the nemathybomes are still more closely packed (textfig. 26). The nematocysts of the nemathybomes are of two sizes, partly 36—53 × 2.5 μ, partly 62—74 × 5 μ, the latter are often a little curved; one part of the nematocysts appears granulated. The nematocysts of the tentacles are 17—19 × 1.5 to almost 2 μ, their spirocysts 11—14 × 1—1.5 (2) μ. The nematocysts of the actinopharynx are partly 22—26 × 1.5—2 μ, partly 29—36 × 2.5 μ.

The siphonoglyphe is provided with longer cilia than the other part of the actinopharynx.

The 8 "*Edwardsia*-mesenteries" are well-developed, the other 8 mesenteries in the uppermost part of the column are also distinct. I have before described and reproduced the former (Carlgren 1893 Pl. 2 figs. 5—8) from different parts of the body. The longitudinal muscle-pennons are in transverse-sections somewhat elongated and show, at most, about 20, commonly 14—17 folds. They are especially high in the outer and also in the inner part and rather richly ramificated; between these folds there are shorter ones, simple or a little branched (textfig. 28 transverse-section through the upper part of the cnido-glandular tract). The outer lamellar part of the mesenteries is attached to the pennon rather close to the outside. The parietal muscles of the same tract show rather numerous folds, a little branched and attached to thickish off-shoots of the mesogloea, the main lamella of the mesogloea is likewise in the outer part thick (textfig. 29). The expansion of the parietal muscles on the column is the ordinary one.



Textfigs. 28—29. *Edwardsia pallida*. Compare the text!

Remarks. I have before (1893) described this species as a variety of *E. clavata*. A closer examination, particularly of the distribution of the nemathybomes, however, proves that it is well differentiated from the species, called by myself *E. clavata* var. *longicornis* = *E. longicornis*, though they were both of them dredged in the same locality (compare *E. tuberculata*, *longicornis* and *danica*).

Edwardsia danica n. sp.

Dimensions. Physa well-developed. Scapus with a rather well-developed periderm. Nemathybomes from somewhat small to small, scattered, but not closely packed together in groups. Nematocysts of the nemathybomes partly 24—42 × (2.5) 3—3.5 (4) μ, partly 46—72 × 4—5 μ, the latter sometimes very sparse (or absent?). Tentacles in varying numbers unto 20 of ordinary length. Nematocysts of the tentacles 17—19 × 1—2 μ, their spirocysts 10—17 × 1—2 μ. Nematocysts of the actinopharynx partly 15—19 ×

1—2 μ, partly 24—34 $\times$ 2—2.5 μ. Longitudinal muscle-pennons rather strong with folds of ordinary height and a little branched, in numbers less than 20, the stronger folds in the outer part, shortened inwards, and in the innermost part one or two longer folds. Outer lamellar part of the mesenteries attached to the pennon rather close by the centre. Parietal muscles comparatively weak, dichotomously branched. Expansion of the parietal muscles on the column considerable.

Colour. Scapus dirty-grey to ochreous-coloured.

Dimensions. In extended state the largest specimen with 20 tentacles (from Little Belt) was 2.4 cm high and 0.2 cm broad. The largest, a little contracted, specimen was 2 cm long and 0.25 cm broad.

Occurrence. Cattegat (Petersen), Torboskär-Skagen 19—22 fms. (Gunhild-Exp. 1878), Little Middelgrund 10 fms. (Gunhild-Exp. 1878), Laholm bay 10—12 fms. (Gunhild-Exp. 1878), Great Belt Winther), Little Belt (Mortensen 1900), 7—24 fms. (Schiödte), off Lyngs Odde 10 fms. (Mortensen 1912), Samsö Belt (Winther).

The Sound (Möller, Lütken). Between Landskrona and Haken 17—21 m S. of Hven 17—26 m; W. of Knähaken 23-25 m, W. of "Disken" 24 m ("Sven Nilsson" St. 27, 30, 42, 43 a, 52c), S. of Hven 6—24 fhs. (Gunhild-Exp. 1878).

Exterior aspect. The physa is of usual appearance. The scapus is provided with a rather well-developed periderm. The nemathybomes are small, not visible to the naked eye and not protuberated on the surface of the scapus. They are scattered, not as numerous and not as aggregate as in *E. pallida*, which becomes evident by a comparison of the figs. 16 b, 17, p. 32.

In surface preparations (textfig. 17) as well as in sections (textfig. 27) they show a different agroupment. Sometimes two nemathybomes close by each other are seen in contracted specimens of *E. danica* (textfig. 27); in shape they are, however, different from those of *E. pallida*. In order to control the arrangement of the nemathybomes I have sectioned several specimens of both species, examined them in surface preparations and always found thorough differences in the agroupment of the nemathybomes. The tentacles are of usual size and appearance. They vary considerably in number. In the smallest, extended specimen from Little Belt (Mortensen 1912) there were only 12 tentacles (this specimen is, however, probably not fertile; I have sectioned the lower part of it, but not found any reproductive organs); in 3 other sectioned fertile specimens (from Samsö Belt, Little Belt and the Sound St. 27) the number of tentacles was 14, 16 and 16. The best, extended specimen (from Little Belt Mortensen 1912) with evolved tentacles had 20 tentacles. In *Edwardsia pallida* I have observed only 16 tentacles. The oral disc and the actinopharynx are of usual appearance. A weak, ventral siphonoglyphe is present.

Anatomical description. The periderm of the scapus is rather well-developed, in the paler specimens thinner. The nemathybomes are small and contain nematocysts of two different sizes, both a little broader at the basal end. The large capsules were mostly very sparse, in some specimens I did not find any in the maceration preparations; it is, however, possible that they are present also there. In the maceration preparations of the specimens 4 and 5 (compare the table) I observed only some few capsules. They always show a discernable basal part to the spiral thread what is also often the case with the smaller nematocysts. The nematocysts of the actinopharynx are also of two sizes. The size of the spirocysts (sp.) and nematocysts (n) in the diverse regions of the body is as follows.

Habitat	nemathybomes n.		capitulum n.	tentacles n.	tentacles sp.	actinopharynx n.	actinopharynx n.
1) Little Belt (Mort. 1900)	29-39 × 3.5-4 μ	55-72 × 5 μ	—	17-19 × 1-2 μ	10-14 × 1-2 μ	—	24 × 2-2.5 μ
2) — (— 1912)	24-33 × (2.5) 3*	—	7-12 × 1.5 μ	17-19 × 2	10-17 × 1-2	—	—
3) — (Schiödte) .	26-43 × (2.5 3-3.5	—	—	—	—	—	—
4) The Sound (St. 27)	29-41 × 3.5-4	55-65 × 5	—	—	—	—	—
5) — (St. 42)	24-41 × 3	46-55 × 5	—	17-19 × 2	10-14 × 1-1.5	17-19 × 1.5-2	29-34 × 2.5
6) — (St. 43 a)....	32-43 × 3	48-65 × 4.5-5	—	14-18 × 1.5-2	10-14 × 1.5	15-19 × 1.5-2	26-31 × 2-2.5
7) — (St. 30)	29-43 × 3-3.5	53-72 × 4-5	—	—	—	—	—
8) — —	26-41 × 3-3.5	—	—	—	—	—	—
9) — (Lütken)...	31-43 × 3-3.5	—	—	—	—	—	—

* Measured on sections.

The 8 "*Edwardsia*-mesenteries" have well-developed, longitudinal pennons. The folds are rather high, but not as branched as in *E. pallida* (textfigs. 30, 31). The most ramificated folds are situated in the outer part, but also in the innermost part there are one or two such folds. The middle part of the pennon is more weak. The number of the folds is about the same as in *E. pallida.* The outer lamellar part of the mesenteries is attached to the pennon at some distance from its outside, in the reproduced pennon (fig. 30) a little nearer to the centre. The parietal muscles are comparatively weak, and more or less dichotomously branched (textfig. 32), they are, however, sometimes a little stronger than the reproduced ones. The expansion of the parietal muscles on the column is considerable.

Fig. 30.

Fig. 31.

Fig. 32.

Textfigs. 30-32. *Edwardsia danica.* Transverse sections of pennons (figs. 30, 31) and parietal muscle (fig. 32) in the upper part of the reproductive tract. Figs. 31, 32 spec. from Little Belt (Mortensen 1900). Fig. 30 from the Sound St. 27 (»Sven Nilsson«).

Remarks. Among the Swedish species this species is the most nearly related to *E. pallida.* The arrangement of the nemathybomes is, however, another here, the number of tentacles in some cases greater, the smaller nematocysts of the nemathybomes shorter, etc.

Edwardsia arctica n. sp.

Dimensions. Physa ordinarily developed. Scapus with a rather well-developed periderm, especially in the lower part. Nemathybomes somewhat large, probably arranged in 8 longitudinal rows, possibly a little scattered in the proximal part. Nematocysts of the nemathybomes 38—60 × 4—5 μ, those of the capitulum about 14 μ long. Tentacles 16. Nematocysts of the tentacles 19—26 × 2—2,5 μ, their spirocysts 12—24 × about 3 μ. Nematocysts of the actinopharynx partly 29—41 × 3—3.5 μ, partly (24) 26—34 × 4—6 μ, the latter with discernible basal part to the spiral thread. Longitudinal muscle-pennons with few, 10—13 folds, only branched in the outer part. The outer lamellar part of the mesenteries attached to the pennon next to the outside. Parietal muscles ordinarily developed, in transverse sections through the distal part of the column looking like a half-opened fan. The expansion of the parietal muscles on the column considerable.

Colour in alcohol, rusty- to ochreous-coloured, in the distal part sometimes dirty-grey.

Dimensions in contracted state. Length to about 0.9 cm, breadth to about 0.35 cm.

Occurrence. East-Greenland. Mackenzie bay north of Franz Joseph's fiord 12—35 m mud (Sw.-Polar-Exp. 1900. N. 17) 2 sp., Scoresby Sound Famae islands 70°5′ N. 22°33′ W. 5—9 m mud (Sw.-Greenland-Exp. 1899 No. 32) 5 sp. South of the little Pendulum island 74°35′ N. 18°23′ W. 18—21 m mud and sand (Sw. Greenland Exp. 1899 No. 20) 1 sp.

Jan Mayen 71°12′ N. 8°28′ W. 1275 m grey clay (Sw. Greenland-Exp. 1899 No. 17) 1 sp. (badly preserved and young specimen, determination dubious.

Nova Zembla Matotschkin Sharr 2—5 fms. clay and sand (Nova Zembla-Exp. 1875 No. 80).

Kara Sea 73°38′ N. 63°45′ E. 80 fms. shells (Nordenskiöld-Exp. 1876, No. 38) 2 sp.

Exterior aspect. The physa is ordinarily developed and perforated by apertures. The scapus is provided with a periderm, most developed in the proximal part, the distal part of the scapus is polygonal. The nemathybomes are rather large, possibly a little irregularly arranged in the proximal part; in the distal part they form an undulating row in the middle of each compartment. It is probable that the nemathybomes are grouped in 8 longitudinal rows, but as all the animals were very strongly contracted this arrangement may have been disturbed by the contraction. The capitulum is of usual appearance. The tentacles are 16 in number. The actinopharynx and the siphonoglyphe were not well preserved.

Anatomical description. The ectoderm of the physa is high with scattered nematocysts, 10—14 μ long. To the physa foreign bodies sometimes adhere. The ectoderm of the scapus is rather high with an ordinarily developed periderm, to which a great many foreign bodies are sticking. The nematocysts of the nemathybomes are numerous. A general view of the size of the nematocysts of the examined specimens shows as follows.

Habitat	scapus	tentacles	actinopharynx n (a)	actinopharynx n (b)
Mackenzie bay	48-60 × 5 μ	22-26 × 2.5 μ	34-38 × 3.5 μ	31-34 × 5-6 μ
Famae Islands	38-58 × 4	22-24 × 2.5	34-41 × 3.5	26 × 5 (few observed)
Pendulum Isl.	41-50	22-24 × 2.5	29-36 × 3.5	—
Matotschkin Sharr	41-50 × 4-5	—	—	—
Kara Sea	43-53 × 4-5	19-24 × 2-2.5	34-36 × 3	24-29 × 4-5

in the (b) nematocysts of the actinopharynx the basal part to the spiral thread is discernible.

The ectoderm of the capitulum is high and contains scattered nematocysts, about 10—12 μ long. The ectoderm of the tentacles is provided with numerous nematocysts 19—26 $\times$ 2—2.5 μ, and very numerous spirocysts, 12 $\times$ 1.5—24 $\times$ 3 μ. The actinopharynx-ectoderm contains, in addition to the nematocysts

Fig. 33.

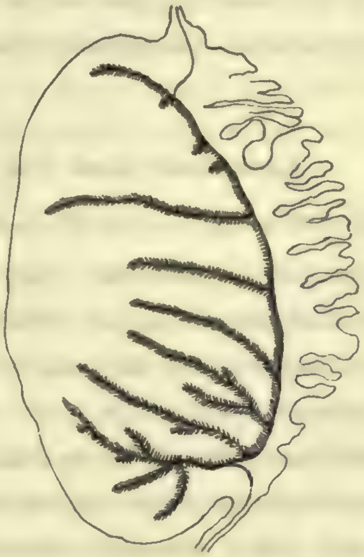


Fig. 34.

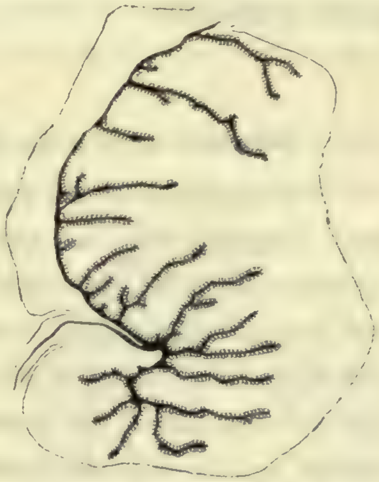


Fig. 35.

Fig. 36.

Fig. 37.

Fig. 38.

Edwardsia arctica. Transverse sections of pennons (fig. 33—35) and parietal muscles (fig. 36—38) in the reproductive tract. Figs. 33, 36, specimen from Scoresby Sound, figs. 34, 37 specimen from Mackenzie Bay. Figs. 35, 38 specimen from the Kara Sea.

mentioned in the table above, also smaller nematocysts, 19—26 $\times$ 2—2.5 μ; possibly these latter belong to the involved tentacles.

The imperfect mesenteries are very weak. The longitudinal muscle-pennons of the 8 "*Edwardsia*-mesenteries" are not strong and form in the reproductive tract about 10—13 only slightly ramified folds. The sections through the reproductive region of three specimens, textfig. 33 spec. from Scoresby Sound (a), textfig. 34 spec. from Mackenzie Bay (b), and textfig. 35 spec. from the Kara Sea (c) show a great conformity in the arrangement of the folds. The endoderm on the opposite side of the muscle-pennons is strongly lobed, the most conspicuously in the specimens a and b; in c the folds are sticking together so that the outline seems to be more even. On the pennon-side the endoderm is, on the other hand, richly provided with vacuoles. The outer, lamellar part of the mesenteries is attached to the pennon, close by its outside. The parietal muscles (textfigs. 36—38) are comparatively strong, now fan-shaped, now — especially in the distal part — elongated towards the centre. The shorter folds are mostly situated in the inner part of the muscle. The expansion of the parietal muscles on the column is rather considerable. The ciliated streaks are well-developed. The species is dioecious.

Edwardsia fusca Dan.

Edwardsia fusca n. sp., Danielssen 1890 p. 112, Pl. 5, fig. 6, Pl. 19, figs. 5—9.

Diagnosis. Physa well-developed, ampullaceous. Scapus with a well-developed, incrusted periderm, polygonal, with 16? rows of small nemathybomes. Their nematocysts about 31—36 × (2)—2.5 μ. Capitulum polygonal. Tentacles 12. Nematocysts of the tentacles 24—27 × 2.5 μ, their spirocysts 14 × 1.5 —26 × 2.5 μ. Nematocysts of the actinopharynx 36—46 × 2,5—3 μ. Longitudinal muscle-pennons of the mesenteries rather strong, in the ciliated tract with 15—20 especially in the outer part richly ramified folds. Outer lamellar part of the mesenteries attached (in the ciliated tract) close by the outside of the pennons. Parietal muscles somewhat strong with rather numerous transversely elongated folds. Expansion of the parietal muscles on the column probably the ordinary one.

Colour. Capitulum brownish-red with 12 rather broad, dark-auburn lines, between which paler longitudinal areas are observed. Oral disc flesh-coloured with two brown annuli of small, brown patches. Tentacles with 3 dark-brown annuli. Scapus brown, physa flesh-coloured (Danielssen).

Dimensions in extended state: Length of the body, tentacles included, 5.5 cm, scapus 2.8 cm. Capitulum 1.2 cm (Danielssen). The strongly contracted specimen, sectioned by myself, was about 1 cm long.

Occurrence. 70°36′ N. 32°35′ E. 271 m clay. Bottom temperature 1°9. (Norwegian North-Atl.-Exp. St. 262) 1 sp.

Exterior aspect. The physa is ampullaceous, well-developed and provided with 8 fine, longitudinal lines (probably the discernible insertions of the mesenteries). The scapus is provided with a strongly incrusted periderm, its form is cylindrical. Between the insertions of the mesenteries there are 16 rows of small nemathybomes in all, two in each compartment (Danielssen). (In the specimen, examined by myself, the nemathybomes were indistinct and seem to be more irregularly arranged, it is therefore questionable, if the nemathybomes are arranged in such a way as stated by Danielssen. The mesenterial furrows were indistinct in the proximal part, distinct in the distal one.) The capitulum is well-developed, in the distal part, close below the oral disc, provided with 12 ridges, proximally reduced to 8. According to Danielssen there are papillae (nemathybomes?) in the physa as well as on the capitulum. (This statement is certainly not correct, as the nemathybomes of *Edwardsia* never appear on the capitulum nor on the physa.) The tentacles are 12 in number. The oral disc is inconsiderable. Actinopharynx and siphonoglyphe? — The above description is compiled from that of Danielssen, I have placed my own remarks in brackets.

Anatomical description. Danielssen has described this species anatomically, but in most cases erroneously. I have only been able to examine a specimen imperfectly, mainly in the region of the scapus. Though my observations need completing, I think that they may aid to characterize the species.

The ectoderm of the scapus is very thin in comparison to the mesogloea, the periderm thick, and the small nemathybomes provided with (rather sparse?) nematocysts of a length of about 31—36 μ and a breadth of (2) 2.5 μ. The nematocysts were commonly not well preserved. Danielssen has reproduced a section through the scapus (Pl. 19, fig. 7) giving a rather good figure of the scapus. The nematocysts of the tentacles are 24—27 μ in length and 2.5 μ in breadth, their spirocysts vary from 14 × 1.5 μ to 26 × 2.5 μ. The ectoderm of the scapus is provided with numerous gland-cells, the nematocysts of which are 36—46 × 2.5—3 μ.

The longitudinal pennons of the mesenteries are rather strong, in the region of the ciliated tract with about 15—20 folds, somewhat richly branched, especially in the outer part. The innermost fold is longer than the largest one of the middle part. The lamellar outer part of the mesenteries are attached to the pennon close by its outer edge (textfig. 39). The parietal muscles were not well preserved, strong with rather numerous, long folds, running parallel to the column. Their expansion on the column is probably the ordinary one, but it is difficult to decide, on account of the strong contraction of the muscles. The ciliated streaks are of the usual structure.

Textfig. 39. *Edwardsia fusca.* Transverse section of pennon in the ciliated tract.

Remarks. The anatomical figures 8 and 9, Pl. 19 in the work of Danielssen are quite useless. The figure 9 illustrates nothing, and as to the figure 8 it need hardly be said that the capitulum and the actinopharynx are not sectioned, as declared by Danielssen, but only the scapus, of which one part is involved. This confusion of the body-parts also explains Danielssen's statement that the capitulum has papillae. In many other respects Danielssen's description is certainly wrong, for instance his account of the actinopharynx and of the reproductive organs, as well as his discovery of acontia.

Edwardsia andresi Dan.

Edwardsia andresi n. sp. Danielssen 1890 p. 106, Pl. 5, fig. 5, Pl. 20.

— — Dan., Appellöf 1893 p. 12, Pl. 3 fig. 19, Carlgren 1904 p. 542—543 fig. 8, Carlgren in Nordgaard 1905 p. 158.

Diagnosis. Physa well-developed, perforated by apertures. Scapus with a thin, easily deciduous periderm. Nemathybomes accumulated in the middle line of each compartment, but not forming a single, longitudinal row. Nematocysts of the nemathybomes 48—67 × 3.5—4 μ, those of the capitulum 10—12 μ in length. Tentacles 12, seldom 13—15. Nematocysts of the tentacles numerous, 24—29 (34) × 2—2.5 μ, their spirocysts numerous, from 12—14 × 1—1.5 μ to 26 × 2.5 μ. A weak ventral siphonoglyphe. Typical nematocysts of the actinopharynx (29) 36—43 × 3.5—5 μ, nematocysts with distinct basal part to the spiral thread 24—29 × 4—5 μ. Longitudinal muscle-pennons of the mesenteries strong, in transverse-sections of the reproductive region rather elongated with some twenty to some thirty folds, somewhat ramificated, especially in the outer part of the pennon. The outer lamellar part of the mesenteries attached to the pennon not far from the outside of it. Parietal muscles very strong, in transverse-sections often more or less trianguloid with rather richly branched folds. The expansion of the parietal muscles on the column is considerable.

Colour. Scapus green with a few brownish-yellow patches, capitulum and tentacles pellucid. At the uppermost margin of the capitulum some dots of a rather intense brown colour, placed two and two together on a milky-white ground, appear like a double ring — a brown one and a white one below. Tentacles of the extremities of a faint violet, extending like a fine line a short way down the aboral side; they also have a brown annulus at the base. Oral disc brown, of a somewhat paler colour than the brown actinopharynx (Danielssen). In preserved state the periderm is dirty-green or -grey, sometimes more or less dirty-ochreous-coloured.

Dimensions in expanded state. Length of the column 9 cm, breadth of the same 0.8—1 cm, length of the tentacles 1.6—2 cm (Danielssen). In preserved and very contracted state the length amounts to 2.7 cm.

Occurrence. Davis Strait. 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3°9 (Ingolf-Exp. St. 32) 1 sp.
West Greenland. Bredefiord 220—310 m. (Rink-Exp. 1912 St. 64) 1 sp.
Iceland 6—7 miles N. W. of Borgarfiord 85 fms. (Haller 1867) 1 sp.
Beeren Island-Spitzbergen. 75°58′ N. 13°18′ E. 350 m. (Sw. Spitzbergen-Exp. 1898 No. 41) 1 sp.
Norway-Beeren Island. 73°27′ N. 23°11′ E. 460 m. (Sw. Spitzbergen-Exp. 1898 No. 2) 11 sp.
Norway Finmark Skjerstadfiord 320 m. (Nordgaard) 481 m.; Bottom temp. 3°2 (Norw. N. Atl.-Exp. 1877 St. 253) numerous sp.
— — Lyngen 300 m bottom temp. between 3°5 and 3°65 (Nordgaard 1899) numerous sp.
— — Ögsfiord (Sars labelled *Edwardsia duodecimcirrata)*.
— — Tromsö Faernes (1881).
North Atlantic. 61°40′ N. 3°11′ E. 220 fms. Bottom temp. 6°34 (Michael Sars-Exp. 1902 St. 51).).
Skagerrak 139 fms., 300 fms. (J. Lindahl 1877) numerous sp.

Exterior aspect. The physa is well-developed and perforated by apertures in such a way as described by me below in *E. vegae*. The long scapus is provided with a thin, sometimes transparent, rather easily deciduous periderm which sometimes may be incrusted with foreign bodies. In its contracted state the mesenterial furrows are very distinct, wherefore the scapus seems polygonal, and also when the scapus is extended, these furrows are rather conspicuous. According to the figure reproduced by Danielssen there is in each compartment a single, longitudinal row of nemathybomes. Such a regular arrangement I have never observed, neither in a type-specimen nor in the numerous specimens examined by myself. In the contracted specimens the nemathybomes are commonly more irregularly arranged, though collected in the middle line between the insertions of the mesenteries. On transverse-sections two or exceptionally some more nemathybomes may simultaneously be hit in the middle line. Also in 3 expanded specimens (from Faernes, Lyngen (textfig. 18) and Davis Strait) I have observed the same irregular arrangement with sometimes 2 or a few more nemathybomes besides each other. In strongly contracted individuals the nemathybomes appear very indistinctly, so that the scapus seems to be smooth. The capitulum is short, smooth, with shallow, mesenterial furrows. It is not provided with papillae (nemathybomes?) as Danielssen says. The number of tentacles is generally 12 which I have observed in a great number of specimens; I have found 13 tentacles once, 14 three times and 15 once. In the specimen from Bredefiord one tentacle was provided with an offshoot at the base, another one was bifurcated, circumstances which are probably connected with a regeneration. The inner tentacles are — as usual in *Edwardsia* — shorter than the outer ones. The oral disc is small, the mouth oval. The actinopharynx is provided with 8 longitudinal furrows, a distinct ventral siphonoglyphe is present.

Anatomical description: The ectoderm of the physa is of ordinary height with sparse, scattered nematocysts, about 12 μ long. In contracted specimens the mesogloea is in the periphery of the physa thicker than the ectoderm, thinner in the centre of it. Its endoderm is higher than its ectoderm and rich in vacuoles, as is usually the endoderm of the column. The periderm and the ectoderm of the scapus are thin. The nemathybomes are rather large and, especially in the distal part of the column, provided with numerous, often a little curved nematocysts. Their size varies between 48 and 67 × (3) 3.5—4 μ. The following table shows the size of the nematocysts of a series of specimens:

Habitat	scapus	tentacles	actinopharynx
Faernes	48—67 × 3.5 μ	—	38—46 × 3.5—4.5 μ
Iceland	56—62 × 3.5—4	24—34 × 2.5 (3) μ	36—43 × 3
Skagerrak	48—53 × 3—3.5	25—29	36—43 × 4—5
Lyngen	48—62 × 3.5	—	—
Beeren Isl.—Spitzbergen	48—60 × 3.5	—	—
Norway—Beeren Isl.	48—65 × 3.5	24—29 × 2	(29)—43 × 4—5
St. 51 "Michael Sars"	50—62 × 3—4	—	—
Davis Strait	53—61 × 3—3.5	24—29 × 2—2.5	34—41 × 4

The endodermal, circular muscles are well-developed. The ectoderm of the capitulum is high and provided with numerous, about 10—12 μ long, thick-walled nematocysts. At the base of the ectoderm there is a well-developed layer of nerve-cells and fibrillae which Appellöf (1893) was the first to observe and reproduce. The nematocysts of the tentacles are numerous, (concerning their size compare the table!), the spirocysts vary from 12 × 1—1.5 μ to 26 × 2.5—3 μ. The longitudinal muscles of the tentacles and the radial muscles of the oral disc are well-developed. The ectoderm of the actinopharynx is high in the ridges, in the furrows lower, its nematocysts numerous. The siphonoglyphe is distinct and provided with longer cilia than the other part of the actinopharynx.

The imperfect mesenteries in the most distal part of the body are comparatively well-developed. If only 4 of these are present, they are found in the lateral and ventro-lateral "*Edwardsia*"-compartments (textfig. 9). The longitudinal muscle-pennons (textfigs. 40—42) of the 8 perfect mesenteries are strong, in transverse sections through the reproductive tract rather elongated and provided with some twenty to some thirty folds of ordinary height. These folds are rather richly branched, especially in the outer and in the innermost parts. The inner folds are commonly considerably shorter than the outer ones, and the outer part of the mesenteries attached close by the outside of the pennons. The parietal muscles (textfig. 43—45) are strong; in transverse-sections in the reproductive region and a little higher up more or less trianguloid and rather richly branched. The inner part of the parietal muscles displays short, somewhat thick folds. In the textfigs.

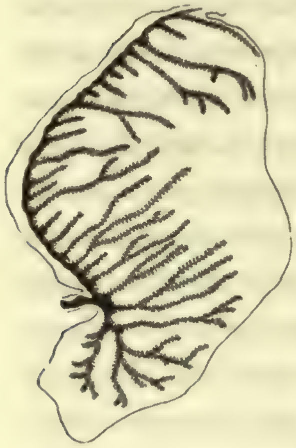


Fig. 40.

Fig. 41.

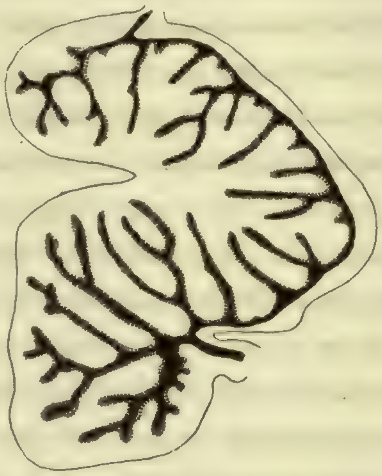


Fig. 42.

Textfigs. 40—45. *Edwardsia andresi*. Transverse sections of pennons (figs. 40-42) and parietal muscles (figs. 43-45) in the upper part of the reproductive tract or a little above (fig. 41). Figs. 40, 43 spec. from Bredefiord. Figs. 41 type-specimen. Fig. 44 spec. from Lyngen. Figs. 42, 45 specimen from Iceland (younger than the others).

Fig. 43.

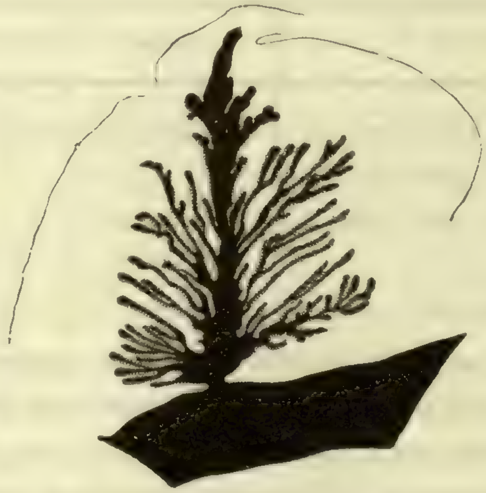


Fig. 44.

Fig. 45.

43—45 I have reproduced the parietal muscles of three specimens from different localities. These figures plainly show the conformity of the three specimens, as do also the figures of the corresponding longitudinal pennons (textfigs. 40—42). The expansion of the parietal muscles on the column is rather inconsiderable. The ciliated and the intermediate streaks are well-developed, in the proximal part of the filaments there is a distinct boundary streak. Danielssen states that acontia are present, but that is certainly not so. The species is dioecous.

Remarks. The description of the species given by Danielssen differs in several respects from mine.

Among Danielssen's figures of the species only the figures 1, 2, 3, 5 and 13 (Pl. 20) are usable, but nowise good, the others are very bad. The section reproduced in the figure 7 has in the centre not hit the actinopharynx, but the involved part of the column; the figures 10 and 11 show nothing as to the presence of acontia and testes. As already corrected by Appellöf (1893 p. 18) this species has normally developed directive mesenteries.

The above description of the species is based not only on a type-specimen but also on several individuals from different localities.

Edwardsia islandica n. sp.

Diagnosis. Physa rather well-developed. Scapus with a very strong cuticle and with rather few, scattered, small nemathybomes. Nematocysts of the nemathybomes 36—48 × 2—2.5 μ. Tentacles 16. The nematocysts of the tentacles about 22—24 × 1.5 μ, their spirocysts 12—17 × 2—2.5 μ? The nematocysts of the actinopharynx (33) 36—43 × 2 μ. Longitudinal muscle pennons of the mesenteries somewhat strong with a few (to about 12) folds which are of about equal height and rather richly branched. Lamellar outer part of the mesenteries in the upper part of the reproductive region attached to the pennons not far from the outside of these latter. Parietal muscles, especially in comparison with the pennons, very strong, mostly triangulоid and with numerous folds. The expansion of the parietal muscles on the column is considerable.

Colour?

Dimensions: Breadth of the column 0.4 cm. As to the length I cannot give any exact information, the single specimen, dredged at the same time as *E. tuberculata* having been sectioned, and the thickness of the sections not having been stated.

Occurrence: South of Iceland 63°15′ N. 22°23′ W. 326—216 m (Thor-Exp.) 1 sp.

Exterior aspect: The physa is rather well-developed. The scapus is provided with a very strong cuticle and with rather few, small, scattered nemathybomes. The capitulum is polygonal. Number of tentacles 16. The actinopharynx is strongly folded. I cannot decide whether a siphonoglyphe is present or not, the ectoderm of the actinopharynx not being well preserved.

Anatomical description: The ectoderm of the physa was considerably higher than that of the scapus. The scapus-ectoderm is provided with a thick cuticle which in several places may become as thick as the ectoderm. The cuticle very much recalls that of *Isoedwardsia ingolfi*, though it is not quite as thick. It is strongly folded because of the strong contraction of the scapus. The small nemathybomes only contain a single kind of capsules 36—48 × 2—2.5 μ in size. The ectoderm of the capitulum is higher than that of the scapus. The nematocysts and spirocysts of the tentacles and the nematocysts of the actinopharynx I have only been able to measure in sections. The nematocysts of the tentacles are about 22—24 × 1.5 μ, the spirocysts about 12—17 × 2.5 μ; the latter measures are, however, very uncertain. The numerous nematocysts of the actinopharynx were (33) 36—43 × 2 μ. The nematocysts of the tentacles and of the actinopharynx are measured on sections.

The 8 "*Edwardsia*"-mesenteries are rather strong with some few (to about 12) folds which are of about equal height and show a tendency to rich ramification (textfig. 46). The small, imperfect mesenteries of the uppermost part of the column are thick. The parietal muscles, especially when compared with the longitudinal pennons, are strong, trianguloid and provided with numerous folds, particularly in the upper part of the reproductive tract (textfigs. 47, 48). The expansion of the parietal muscles on the column is considerable and comprises about the whole breadth of the parietal muscles. The ciliated streaks are well-developed. The specimen was a male.

Fig. 46.

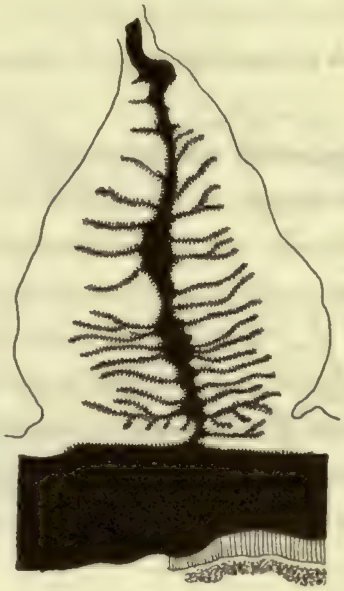


Fig. 47.

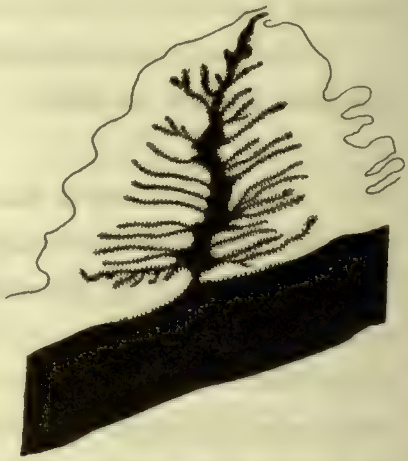


Fig. 48.

Textfigs. 46—48. *Edwardia islandica.* Transverse section of pennon (fig. 46) and parietal muscles (figs. 47, 48) in the upper part of the reproductive tract.

Edwardsia incerta n. sp.

Diagnosis: Physa well-developed. Scapus with a thick ectoderm, incrusted with foreign bodies, with scattered, large nemathybomes, containing a few nematocysts 29—37 × 5 μ in size. Tentacles not more than 16, probably 12. Nematocysts of the tentacles 22—26×2 μ, the spirocysts 14—22 μ in size. Longitudinal muscle pennons of the mesenteries in transverse-sections with some few, about 12 folds, only ramificated in the outer parts. The lamellar outer part of the mesenteries attached close by the outside of the pennons. Parietal muscles comparatively well-developed, in transverse-sections fan-shaped, considerably broader than in *E. arctica*. The parietal muscles are considerably expanded on the column.

Textfig. 49. *Edwardsia incerta.* Compare the text!

Colour in alcohol: Scapus dirty grey.

Dimensions in contracted state: length 0.9 cm, breadth 0. 15 cm.

Occurrence: East-Greenland 72°28′ N. 21°48′ W. 180 m mud with some stones (Sw. Greenland-Exp. 1899) 1 sp.

The muscle pennons of the mesenteries of these species recall those of *E. arctica*; the nematocysts of the nemathybomes, however, differ in size. On account of the imperfect and badly preserved material I cannot give any minute description of the species. A transverse-section of a muscle pennon and of a parietal muscle is reproduced in textfig. 49.

Edwardsia vitrea (Dan.) Carlgr.

Pl. 1, Figs. 5, 11.

Edwardsioides vitrea n. sp. Danielssen 1890, p. 100, Pl. 5, fig. 3, Pl. 16, figs. 4—10.

Diagnosis: Physa rather well-developed. Scapus with a very thin periderm, with scattered nemathybomes, the nematocysts of which are (34) 36—42 × 3—3.5 μ. Number of tentacles 13—16. Nematocysts of the tentacles 17—29 × 2.5—3.5 μ, the spirocysts unto 29 × 2.5—3.5 μ. Nematocysts of the actinopharynx very numerous, partly (31) 36—53 × 2.5—3.5 μ, partly 17—24 × 2.5 μ. Longitudinal muscle pennon strong, in the upper part of the reproductive region with 20—30 longer and shorter folds, the former with numerous, small secondary folds. The outer lamellar part of the mesenteries attached close by the outside of the pennon. Parietal muscles very strong, in transverse-sections through the reproductive tract often trianguloid, with very numerous, long, closely packed folds. The expansion of the parietal muscles on the column the ordinary one.

Colour: Periderm greenish, transparent. The integument inside almost as clear as glass, with a faint play of reddish colour and with pale light-red longitudinal furrows. In fully expanded state the capitulum has a faint, rose-red tinge, and so has the physa. Tentacles beautifully bright-red (Danielssen). Scapus in preserved state dirty-grey or partly ferruginous.

Dimensions in extended state: 4—5 cm in length and 0.8 cm in breadth (Danielssen). In contracted state the length is to about 3 cm and the breadth to about 0.7 cm.

Occurrence: East-Greenland Franz Joseph Fiord 73°16′ N. 23°15′ W. 28—36 m clay with stones sand and shells (Sw. Greenland-Exp. 1899 No. 44) 2 sp.

Spitzbergen Wijde bay 40 fms. (Sw. Spitzberg-Exp. 1861) 1 sp. Great fiord 78°37′ N. 19° E. 5—10 fms. Sand (Malmgren 1864) 3 sp. Great Islet 80°15′ N. 30° E. 95 m (Römer and Schaudinn St. 37) 1 sp.

68°21′ N. 10°40′ E. 836 m clay and sand. Bottom temp. — 0.7 (Norw. N. Atl.-Exp. St. 164) 1 sp.

Exterior aspect: The physa seems to be smaller than in the former, species described. According to Danielssen it is incapable of involution; this is probably not correct. In the examined type-specimen (fig. 5, Pl. 1) the scapus is separated from the physa by an annular lacing in. Danielssen also states that the physa is provided with sparse suckers (nemathybomes?). This is certainly not the case, I never observed any such. On the other hand foreign bodies sometimes seem to be attached to the physa; in the type-specimen there were namely fragments of such adhered to the physa, probably by the secretion of the mucus-cells. According to my examination of the species from Great Islet, the physa of which I have sectioned, the physa is perforated by apertures. The scapus is provided with 8 longitudinal furrows, corresponding to the insertions of the mesenteries, and with scattered, rather numerous nemathybomes. Danielssen declares that the suckers (nemathybomes) are arranged in somewhat regular transversal rows which, however, does not seem to be case. The periderm of the scapus is very thin. When the animal is very much expanded the periderm is almost inconspicuous (Danielssen). The involved part of the scapus is a little polygonal. The capitulum is short and provided with distinct, longitudinal furrows, corresponding to the insertions of the mesenteries.

The statement of Danielssen, that the capitulum has suckers, is not correct. The tentacles were 16 in the specimen from Great fiord, Wijde bay and in the examined type-specimen; the specimens from Greenland had only 13, resp. 15 tentacles. The specimen from Wijde bay (Pl. 1, fig. 11) showed a neomorphose (Carlgren 1904 p. 458). The oral disc is small, the actinopharynx as usual short. Siphonoglyphe?

Anatomical decription: The apertures of the physa are surrounded by circular muscles. At the aperture in the mesogloea there is an annular wall of the epithelium (whether of the ectoderm or of the endoderm I cannot decide, the epithelium not being well preserved). This wall probably forms a movable stop-

Fig. 50.

Textfigs. 50—51.
Edwardsia vitrea.
Section of a central aperture in the physa fig. 50 through the middle part fig. 51 through the rim. cm. circular muscles.

Fig. 51.

ping, differently located according to the different state of concentration of the physa. In the Wijde-specimen the wall turned towards the ectoderm, (textfigs. 50, 51), while in *E. vegae* (compare this species) it turned inwards. The wall is almost exclusively composed of elongated cells with large nuclei. The nemathybomes of the examined type-specimen are flat and, on account of the bad preservation, containing only a few whole nematocysts, the greater part of which are shrivelled, and as the stinging thread is thrown out there is no distinct limit between the capsule and the thread. The nematocysts in the nemathybomes of the other specimens were numerous, excepting the badly preserved Wijde-specimen where I found only a few nematocysts. In the following table I have set up the size of the nematocysts in the different tracts of the animal. It ought to be mentioned that the nematocysts are measured only in sections of the type-specimen. The measures are therefore a little uncertain.

Habitat	scapus	capitulum	tentacles	actinopharynx	
Great fiord	36—38 × 3.5 μ	14—17 × 2 μ	24—29 × 2.5—3.5 μ	38—51 × 3.5 μ	—
68°21′ N (type sp.)	about 38	—	—	36—53 × 3	17—22 μ
East-Greenland	37—42 × 3—3.5	14—17 × 2	17—29 × 2.5—3.5	36—48 × 3.5	20—24 × 2.5
Wijde bay	34—38 × 3	10—12	19—25	31—36 × 3	—

In the specimen from Wijde bay I found only 2 nematocysts in the maceration preparation of the nemathybomes, and in the specimen from Great Islet none, (as the parietal muscles of the latter are very strong it is, however, probable that we have to do with *E. vitrea*).

The periderm of the scapus is very thin and only a little incrusted. The nematocysts of the capitular ectoderm are rather numerous, in the tentacles very numerous. The spirocysts of the tentacles obtain a size of 17—29 × 2.5—3.5 μ, I have also observed smaller capsules. The ectoderm of the actinopharynx is high, several times thicker than the mesogloea, and contains nematocysts of two different sizes.

The longitudinal muscle pennons of the mesenteries are strong. Unfortunately I cannot describe the pennons of the type specimen in the upper part of the reproductive tract as Danielssen has sectioned this

Fig. 52.

Fig. 53.

Fig. 54.

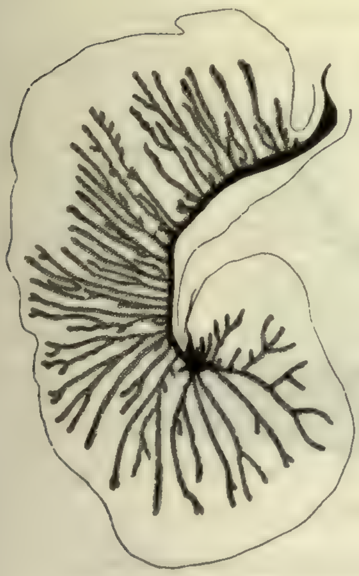


Fig. 55.

Fig. 56.

Textfigs. 52—56.
Edwardsia vitrea.
Transverse section of pennons in the upper part of the reproductive tract (figs. 53, 54) or in a corresponding part (fig. 52). Fig. 52 young specimen from Wijde Bay, fig. 53 specimen from Franz Joseph Fiord, fig. 54 specimen from Great fiord. Figs. 55, 56 Transverse section of a mesentery of the type-specimen, fig. 55 through the lower part of the actinopharyngial region, fig. 56 through the lowest part of the reproductive tract.

part; on the other hand I have been able to examine the pennons of the lowermost part of the actinopharynx region (textf. 55) and of the lowest part of the reproductive tract (textfig. 56). In the latter figure we see that the pennon begins to diminish, showing however numerous branched folds, especially at the outer side. In the former sections we find about 30 high, rather richly ramificated folds, of about equal height. I have reproduced pennons in the upper part of the reproductive region of the specimens from Great fiord (textfig. 54), from Greenland (textfig. 53) and from Wijde bay (textfig. 52); they all agree well. The folds are about 25—30 in number and provided with numerous, small, secondary folds. The outer lamellar part of the mesenteries is attached close by the outside of the pennon. The parietal muscles are very strong, in the inner part commonly more branched than in the outer one, where the high folds sometimes have no branches at all. The folds are numerous and, especially towards the outside, closely packed together. According to the state of contraction the parietal muscles of transverse-sections are of a different appearance; they are, however,

Fig. 57.

Fig. 58.

Fig. 59.

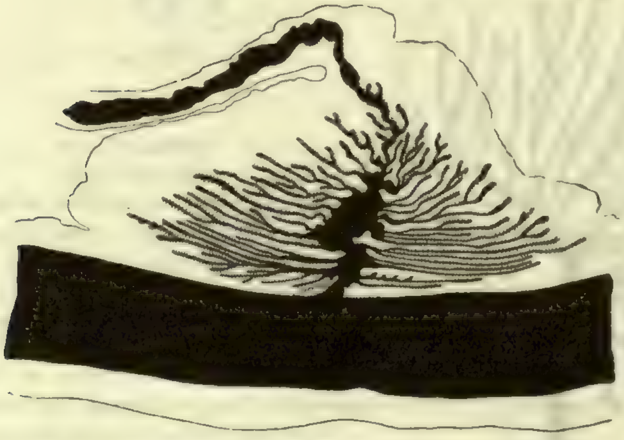


Fig. 60.

Fig. 61.

Textfigs. 57—61. *Edwardsia vitrea.* Transverse section of parietal muscles. Fig. 57: young specimen from Wijde Bay, fig. 58 specimen from Franz Joseph Fiord, fig. 59 specimen from Great Island, fig. 60 specimen from Great Fiord, fig. 61 type-specimen.

more or less trianguloid. For comparing purposes I have reproduced the parietal muscles of five specimens. Especially the muscles reproduced in the figs. 58, 60, and sectioned in the upper part of the reproductive region, do very well agree. The distribution of the parietal muscles on the column is the ordinary one. The ciliated tracts are of usual appearance. The type-specimen as well as the other examined specimens were females. I cannot confirm Danielssen's statement that the species is monoecious. Also in other respects Danielssen's description is erroneous.

Edwardsia vegae n. sp.

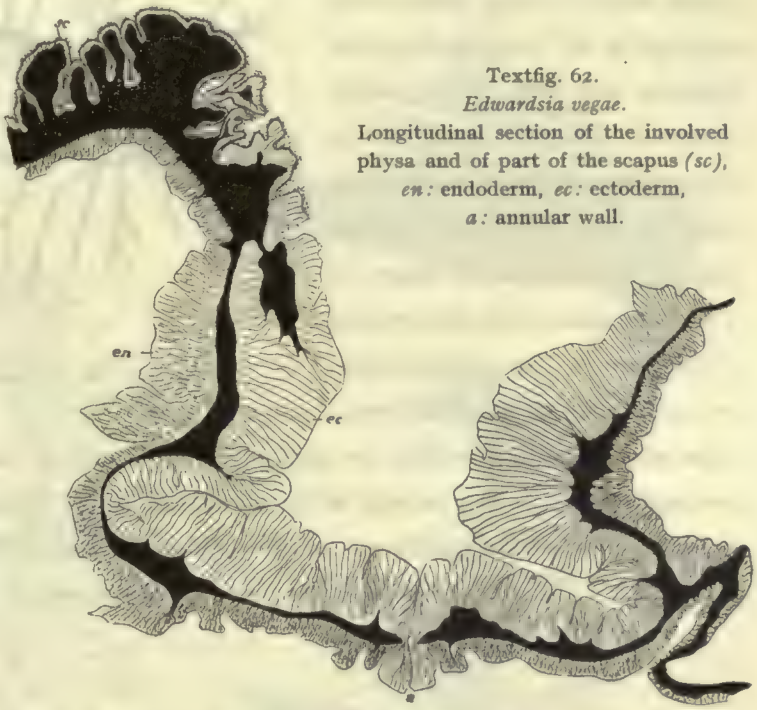
Diagnosis: Physa well-developed, perforated by apertures. Scapus with a rather well-developed periderm, polygonal, with scattered, especially in the lower part large nemathybomes. Nematocysts of the physa 14—19 μ, those of the nemathybomes 84—101 × 3 μ, those of the tentacles 19—24 × 2 μ, those of the actinopharynx 38—43 × 3 μ. Tentacles 16. Longitudinal pennons of the mesenteries in the reproductive region with about 25—30 strong folds which are rather high and richly ramificated in the outer part, low and only slightly branched in the inner one. Outer lamellar part of the mesenteries attached to the pennon at some distance from its outside. Parietal muscles with somewhat numerous, in the outer part closely packed folds; in transverse-sections through the reproductive tract folds trianguloid. Expansion of the parietal muscles on the column?

Colour in preserved state: Scapus dirty-brown.

Dimensions in strongly contracted state with the physa and one part of the scapus involved: Length 1.7 cm, largest breadth about 0.5 cm.

Occurrence: Arctic Sea of Siberia. Off Pittlekaj North of the winter harbour of the Vega 9—10 fms. stones (Vega-Exp. 1879, No. 1002) 1 sp.

Exterior aspect: The physa is well-developed, but involved. It is perforated by a central aperture, surrounded by a ring of probably 8 apertures. The scapus is provided with 8 distinct, longitudinal furrows and is thus polygonal. The nemathybomes are large, especially in the lower part, scattered over the whole surface and distinctly discernible to the naked eye. The capitulum being damaged, I cannot decide whether it is polygonal. The short tentacles are 16 in number. The actinopharynx is short. As it was not well-preserved I cannot say whether a siphonoglyphe is present or not.



Textfig. 62.
Edwardsia vegae.
Longitudinal section of the involved physa and of part of the scapus *(sc)*, *en*: endoderm, *ec*: ectoderm, *a*: annular wall.

Anatomical description: The ectoderm of the physa is very high, considerably thicker than its mesogloea and provided with sparse nematocysts, 14—19 μ long. On transverse-sections through the centre of the physa a central aperture is seen which is probably formed by an involution of the ectoderm (textfig. 62). From the aperture an annular wall (*a*), probably of ectoderm, extends into the coelenteric cavity. (Compare *Edwardsia vitrea*). By the side of the central aperture I have on certain sections observed apertures of similar appearance. Accordingly there is probably a central aperture, surrounded by a ring of 8 apertures. On the inner side of the apertures a distinct layer of circular muscles is developed as in *Halcampa*. The scapus-ectoderm is thin, its periderm ordinarily developed, the mesogloea thick, probably on account of the strong contraction of the body. The nemathybomes are large and contain, in addition to round cells, rather numerous nematocysts, about 84—101 × 3 μ in size. They were often curved and therefore difficult to measure. The endodermal circular muscles of the column are well-developed. The nematocysts of the tentacles are numerous and 19—24 × 2 μ in size, the spirocysts reach a length of unto 18 μ. The rather numerous nematocysts of the actinopharynx are 38—43 × 3 μ.

The longitudinal pennons of the "Edwardsia-mesenteries" are strong, in the reproductive region with 25 to 30 folds which are high in the outer part of the pennons and here rather richly branched, while the inner part is lower and only little ramificated (textfig. 63). The outer lamellar part of the mesenteries issues at a good distance from the outside of the pennon. The parietal muscles are rather strong, with somewhat numerous folds which are long in the outer part, in the inner one short. The former are placed almost perpendicularly to the lamella of the mesenteries; the latter are turned inwards (textfig. 64). Whether the parietal muscles are continued on the column I cannot decide as they were not well preserved in their outer part. The species is dioecious; the specimen was a female.

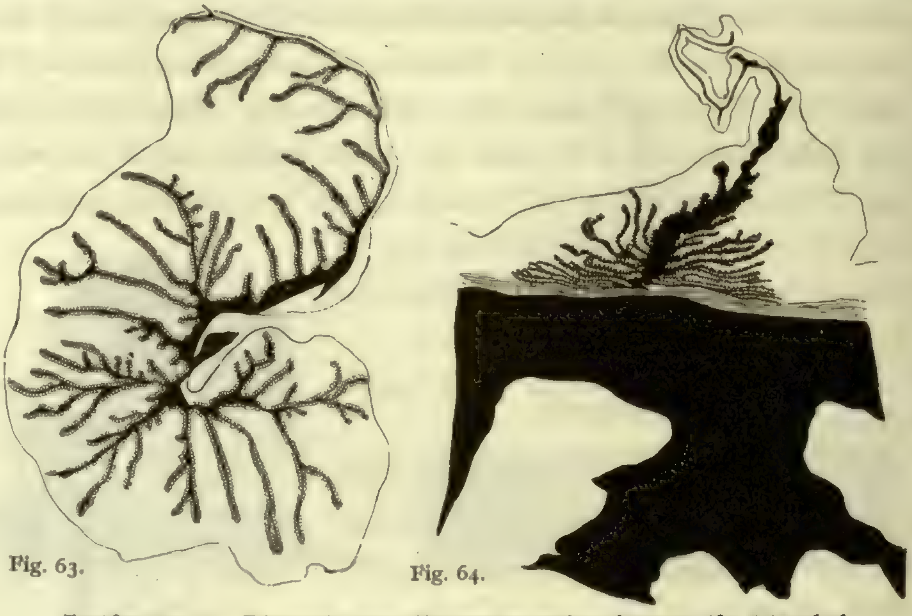


Fig. 63. Fig. 64.

Textfigs. 63—64. *Edwardsia vegae*. Transverse section of pennon (fig. 63) and of parietal muscle (fig. 64).

Edwardsia finmarchica n. sp.

Pl. 1, figs. 10, 12.

Diagnosis: Physa well-developed, perforated by apertures. Scapus-periderm thin. Nemathybomes very small, but numerous, scattered over the whole surface of the scapus, not discernable to the naked eye. Nematocysts of the nemathybomes (26) 36—48 (62) × 3—3.5 (4) μ, those of the capitulum 10—12 μ, those of the tentacles 22—26 × 2.5—3 μ, those of the actinopharynx 30—35 × 2.5—3 μ. Spirocysts of the tentacles 14—17 μ long. Tentacles 16—26 (or more?). Longitudinal pennons of the mesenteries very strong; in transverse-sections elongated; in the reproductive region with about 50, not very high folds which are rather richly branched. The outer lamellar part of the mesenteries attached close by the outside of the pennons. Parietal muscles in the reproductive region not very strong, trianguloid, with comparatively few folds. The parietal muscles are not at all or only very slightly expanded on the column.

Colour in preserved state: Scapus ochreous-coloured.

Dimensions of a well-preserved specimen with extended tentacles. (Pl. 1, fig. 10): Length of the column 3,2 cm, largest breadth 0.45 cm. Physa and capitulum 0.4 cm each.

Occurrence: Norway Finmark (Goës and Malmgren) 5 sp. Tromsö 20 fms. (Goës and Malmgren 3 sp. littoral (Kier) 3 sp.

Exterior aspect: The physa is ampullaceous in extended state and perforated by apertures, the number of which I have not been able to determine with certainty. In a specimen I observed such apertures in 7 compartments. Probably they are arranged in a ring round a central aperture. The specimen from Finmark, mentioned by myself as *E. clavata* (1893, p. 16), belongs to *E. vitrea*. The scapus is provided with a thin periderm in which there are ochreous-coloured incrustations. The nemathybomes are very small, but numerous and scattered. The scapus seems to be smooth, because the nemathybomes only rise a little or not at all over the surface, in contracted as well as in expanded individuals. The proximal part of the scapus is almost round, the distal part polygonal, probably on account of the contraction. The capitulum is short. The number of the tentacles varies considerably. Of 5 examined specimens one had 16, two 22, one 23 and one 26 tentacles, arranged in two or three cycles. The oral disc is small, the actinopharynx short. A ventral siphonoglyphe is present.

Anatomical description: The nematocysts of the physa are 12—14 μ in length. The apertures are surrounded by circular muscles. The numerous nematocysts of the nemathybomes vary considerably in size, they are commonly 31—44 μ long, sometimes shorter, down to 26 μ, sometimes longer, unto 62 μ. The ectoderm of the capitulum is rather thick, with sparse nematocysts, 10—12 μ long. The high ectoderm of the tentacles contains numerous nematocysts (22—26 × 2.5 —3 μ) and spirocysts (14—17 μ long). The ectodermal longitudinal muscles of the tentacles are rather well-developed. The ectoderm of the actinopharynx is high and provided with several ridges; its nematocysts are numerous, 30—35 × 2.5—3 μ in size. The ectoderm of the siphonoglyphe contains very few nematocysts and glandcells; its cilia are longer than in the other part of the actinopharynx.

Fig. 66.

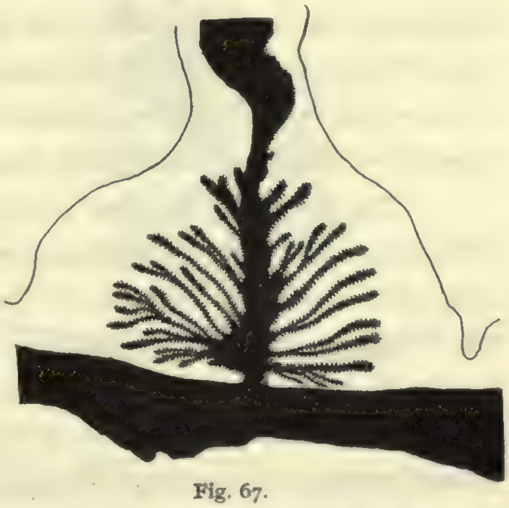


Fig. 65. Fig. 67.

Textfig. 65—67. *Edwardsia finmarchica*. Transverse section of pennon (fig. 65) and of parietal muscle (fig. 66) in the reproduction tract. Fig. 67 Transverse section of parietal muscle in the lower part of the actinopharynx.

The imperfect mesenteries in the uppermost part of the column are rather strong. The longitudinal muscle pennons (textfig. 65) of the "Edwardsia-mesenteries" are very strong, and in transverse-sections through the upper part of the reproductive tract elongated with about 50 folds. These latter are of ordinary length and rather richly branched, especially in the inner and outer parts (several specimens sectioned). Between the larger folds there are smaller ones (textfig. 65). The outer lamellar part of the mesenteries is commonly attached close by the outside of the pennon, sometimes a little more inwards. The parietal muscles are, in comparison with the pennon, not particularly strong; in transverse-sections through the reproductive tract often trianguloid (textfigs. 66, 67) with the longest folds next to the outside. There are not many folds, and they are only a little ramificated; further upwards (textfig. 67) they are more numerous, but never reach the number of folds in *E. vitrea.* The parietal muscles are not at all, or only very slightly expanded on the column. Typically ciliated tracts are present. The species is dioecious.

Remarks: The species is probably nearly allied to *E. sipunculoides*, but differs from this species in longer nematocysts in the nemathybomes and more richly branched muscle pennons.

Genus **Isoedwardsia** Carlgr.

Diagnosis: Edwardsiinae with the column divisible into two regions, capitulum and scapus. Proximal part of the body rounded and, as the other part of the scapus, furnished with nemathybomes. Nematocysts of these latter long and thin. Nemathybomes scattered or arranged in several lines. Scapus with a more or less well-developed cuticle. Nematocysts in the cuticle-lacking ectoderm of the capitulum small. Tentacles 16 or more. Only one feebly developed ventral siphonoglyphe?

This genus, characterized by myself in a few words (1900, p. 26), is distinguished from the nearly related genus *Edwardsia* by the absence of any trace of a physa, while a physa is always present in *Edwardsia*, even if it is sometimes rather small. The ectoderm of the rounded, proximal part of *Isoedwardsia* is therefore furnished with a cuticle which is wanting in this part of *Edwardsia*. Both genera are also differentiated from each other in this respect that the physa never contains nemathybomes in *Edwardsia*, while in *Isoedwardsia* the most proximal part of the body has nemathybomes. Possibly the presence of discontinuous, ciliated streaks which are very distinct in *I. mediterranea* n. sp. also is of systematic importance and characteristic of the genus, but till now we know too little about the occurrence of this structure to be able to use it as a genus character. The type of the genus is *I. ingolfi.* Besides this species I have in the Mediterranean found another one which I will call *I. mediterranea.* It is possible that the latter has been described before as an *Edwardsia*, though at present it cannot be identified with any before known species. The cuticle is much thicker in *I. ingolfi* than in *I. mediterranea*; in the former the muscle-pennons show about 30 folds in the reproductive regions, in the latter about 70. In another paper I will describe a third species, dredged at the Easter Island.

Isoedwardsia ingolfi n. sp.

Pl 1. Figs. 36, 37.

Diagnosis: Cuticle very thick, especially in the proximal part of the body, ectoderm of the scapus thin, also in the proximal part. Nemathybomes numerous, scattered on the scapus. Nematocysts in the nemathybomes 50—60 × 4—5 μ, in the tentacles 31—36 × 3 μ, in the actinopharynx 41—46 × 3—4 μ. Tentacles 16. Longitudinal muscle-pennons of the mesenteries in the reproductive region strong, with about 30, often ramificated folds. Outer parts of the mesenteries issuing not far from the middle of the pennon, Parietal muscles in the reproductive region in transverse-sections oval, with rather richly ramificated folds. Their expansion on the column is inconsiderable.

Colour in preserved state: scapus dirtily ochreous-yellow shading off into grey.

Fig. 68.

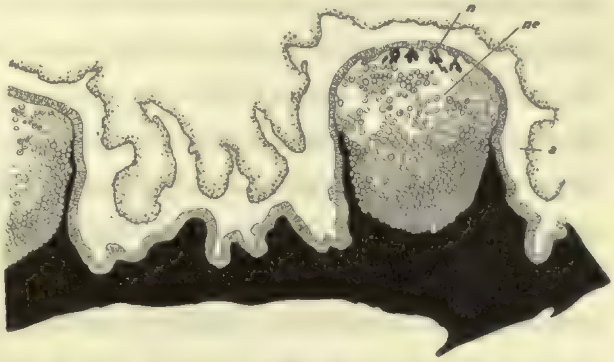


Fig. 69.

Fig. 72.

Fig. 71.

Fig. 70.

Textfigs. 68—72. *Isoedwardsia ingolfi.*

Fig. 68: Section of a portion of scapus in its proximal part. Fig. 69: Section of a portion of scapus in the middle of the aboral body-end. Fig. 70: Transverse section of a pennon in the reproductive region. Fig. 71: Transverse section of a parietal muscle in the reproductive region. Fig. 72: Transverse section of a mesentery in the proximal part.

Dimensions: Spec. 1) Length 1.1 cm., largest breadth, a little above the proximal part of the animal, 0.5 cm. Length of capitulum 0.5 cm. Sp. 2) Length 2.1 cm, largest breadth 0.6 cm (Pl. 1, fig. 36).

Occurrence: 60°37′ N. 27° 52′ W. 799 fms. Temperature of the bottom 4.5° (Ingolf-Exp. St. 78) 2 sp.

Exterior aspect: No physa. The most proximal part of the column is rounded, broader than the other part of the body and totally cuticle-clad (Pl. 1, fig. 36). Scattered nemathybomes appear also in the most proximal end which is more solid than the other part of the body. The proximal end imperceptibly fuses into the other part of the scapus, the cuticle of which is also strong. In all places on the scapus there are scattered nemathybomes which are especially distinct in the smaller, more extended specimen. The longitudinal furrows, corresponding to the insertions of the mesenteries, are rather distinct on the scapus. The capitulum is smooth, transparent, without a cuticle and with distinct longitudinal furrows where the mesenteries insert. The tentacles are badly preserved and stick together, conical, on the larger specimen very extended lengthwise (Pl. 1, fig. 37); 16 in number. The oral disc and the actinopharynx are very macerated.

Anatomical description: The distal parts of the animal are very badly preserved, so that I cannot give any exact description of the structure of the actinopharynx, tentacles or mesenteries of these parts. The ectoderm of the scapus is, in comparison with the mesogloea, very thin, especially in the proximal parts; gradually the ectoderm increases in thickness towards the distal end. Outside the ectoderm there is a very characteristic layer which reaches a considerable thickness, especially in the proximal body-end (textfigs. 68, 69 *a*). In these places this layer is many times thicker than the ectoderm and sometimes almost as thick as the mesogloea from which it only differs a little in structure. While in the homogeneous ground-substance of the mesogloea we rather commonly find fibrillae, but only rarely cells — the part of the mesogloea turned to the endoderm is stained more intensely with borax-carmin and haematoxylin than the outer part which remains almost unstained — the layer outside the ectoderm is more homogeneous, though fibrillae and cells also here exceptionally appear, and is only weakly stained with the above-mentioned colouring matter. This layer outside the ectoderm much recalls the so-called sub-cuticle of the Zoantharia, and this likeness is still more conspicuous, in as mush as a thin, brownish cuticle, to which extraneous bodies are sticking, occurs outside the homogeneous layer in *Isoedwardsia* as well as in Zoantharia, thus forming the outside of the surface of the body. Towards the distal part of the scapus this "sub-cuticular" layer is thinner and does not in its most distal part attain the thickness of the ectoderm.

The nemathybomes are of about the same structure as in *Edwardsia* (textfigs. 68, 69 *ne*); they contain numerous, rounded, somewhat irregular bodies, surrounded, as it seems, by a refractive, thick membrane. The nematocysts (*n*) which in the scapus appear only in the nemathybomes and attein a size of 50—60 × 4—5 μ, are sometimes a little curved, with the basal part to the spiral thread a little translucent. On the reproduced sections, especially on the textfigure 69, they are obliquely sectioned. The ectoderm of the capitulum is higher than that of the scapus and on one specimen sticking to the tentacles. The ectoderm of the tentacles contains numerous, thick-walled nematocysts (their size 31—36 × 3 μ). The spirocysts of the tentacles are of variable length, the longest about as long as the nematocysts in the same part, but about twice as broad. The nematocysts of the actinopharynx are numerous, 41—46 μ long and 3—4 μ broad. The longitudinal muscle-pennons are in the reproductive region, in transverse-sections, elongated with about 30, not densely packed, very often ramificated folds. The larger folds are of ordinary height and almost all of about equal size, the lower folds are sparse (textfig. 70). The parietal muscles are in transverse-sections in the reproductive region oval, with shorter folds in the inner and the outer parts. The folds are often ramificated, numerous and spreading apart (textfig. 71). As to the filaments they are not well preserved in the distal part, but in good condition in the reproductive region. It seems as if they are like those of *I. mediterranea*, in which the ciliated streaks are discontinuous. Inside the glandular streaks which contain numerous nematocysts, but rare gland-cells, there is, in this species, a well differentiated part, an intermediate streak with rare nematocysts and numerous gland-cells. The reproductive organs were in the one, particularly examined specimen, testes with well developed spermatozoa.

Subfam. Milne-Edwardsiinae.

Diagnosis: Edwardsiidae without nemathybomes in the scapus. Nematocysts in the ectoderm of the scapus scattered or in heaps. Physa absent, indistinct or feebly developed. Nematocysts of the capitulum of almost the same size as those of the scapus. Inner tentacles longer than the outer ones; commonly hexamerously arranged.

This subfamily corresponds to the family Milne-Edwardsiidae, proposed by myself (1893, p. 11), and is easily distinguished from the subfamily Edwardsiinae by the absence of nemathybomes. Also the arrangement of the tentacles is another one, at least in the genus *Milne-Edwardsia*, but probably also in *Paraedwardsia* as I have been able to state the same arrangement in *P. sarsii* as in *Milne-Edwardsia*. The tentacles are namely commonly hexamerously arranged, and the inner tentacles are larger than the outer ones (textfig. 11), so this is another agroupment than that of the genus *Edwardsia*. Concerning the number of siphonoglyphes I can ascertain that several species have only one, a ventral one. Whether this is characteristic of the whole subfamily, remains to be confirmed.

This subfamily does not seem as rich in species as the subfamily Edwarsiinae. Very likely the number of *Milne-Edwardsia*-species will increase, when all Edwardsiidae have been subject to a more detailed examination. There is no doubt that several species, described as *Edwardsiella* and *Edwardsia*, belong to this subfamily. Thus, according to my examination, the *Edwardsia timida* Quatr. is a *Milne-Edwardsia*, *M. dixonii*, (verified by myself on material received from Dixon). Besides this, it is not improbable that one part of the forms, described and reproduced by Andres 1883 as varieties of *Edwardsia claparedii*, are in fact *Milne-Edwardsia*- or *Paraedwardsia*-species. In the subfamily I included two genera *Milne-Edwardsia* and *Paraedwardsia*, of which the latter is furnished with "*Halcampa*-papillae", the former not.

Genus Milne-Edwardsia Carlgr.

Diagnosis: Milne-Edwardsiinae with the column divisible into a lower, greater part which is invested with a rather well-developed, sometimes very thick cuticle and an upper minute part, capitulum, without cuticle. A weak physa also sometimes present. Scapus without nemathybomes and "*Halcampa*-papillae". Nematocysts in the ectoderm of the scapus either scattered or arranged in groups, comparatively short, in proportion to the breadth. Nematocysts of the capitular ectoderm commonly large and mainly distributed on the ridges of the capitulum. Capitulum more or less polygonal. Tentacles 12 or in several cycles, hexamerously arranged, the inner longer than the outer ones (alvays?). Only one, ventral siphonoglyphe (always?).

In a certain respect the diagnosis of this genus, published in this paper, is a little more explicit than the original one. The hitherto known species of this genus are: *M. loveni* Carlgr., *M. carnea* (Gosse), *M. polaris* Carlgr., *M. nathorstii* Carlgr. and *M. dixonii* Carlgr. (nov. nomen pro "*Edwardsia timida* Quatr." described by Dixon). It is also possible that *Edwardsia lineata* Verr. will be included in this genus. The species described below are easily distinguished from each other.

Milne-Edwardsia loveni Carlgr.

Pl. 1. Figs. 32, 33.

Milne-Edwardsia loveni n. sp., Carlgren 1892, p. 456, textfig. 3, 1893, p. 17, textfigs. 3, 4. Pl. 1, figs. 6—8, Pl. 2, figs. 1—4, Pl. 10, fig. 3.

— — — Carlgr. Arndt 1912, p. 123.

Diagnosis: No physa. Proximal part of the body of variable appearance, on account of the habits of the animal. Scapus more or less polygonal, with a very strong, often rugous, easily deciduous cuticle. Nematocysts of the scapus scattered, mainly arranged on the ridges, in the lower part about 24 μ long, in the upper 38—48 $\times$ 6 μ. Capitulum distinctly polygonal with sharp ridges. Nematocysts mainly on the ridges 22—30 $\times$ 4 μ. Nematocysts of the tentacles about 22 $\times$ 4 μ. Number of the tentacles to about 30—40. Nematocysts of the actinopharynx partly 17—19 μ, partly 24—29 $\times$ 3 μ. Longitudinal muscle-pennons strong, in the upper part of the reproductive organs with about 20—30 folds.

Colour: Mouth, actinopharynx and reproductive organs brick-red; tentacles and capitulum flesh-coloured. Mesenteries and scapus inside the cuticle of the same colour as the tentacles, but paler, sometimes white. Cuticle of the scapus grey, shading off into brownish-yellow.

Dimensions: Length of the body to about 3,5 cm, of which the capitulum is a fourth part. Largest breadth to about 0,5 cm. Length of the tentacles about 0,35 cm. Actinopharynx one half or two thirds of the length of the capitulum.

Occurrence: Sweden. Bohuslän. Väderöarne about 50 fms. in dead *Lophohelia* (Loven, Olsson, Carlgren, Auriwillius and others). Kosterfjord. Sneholmen 60—120 fms. (Auriwillius) Ramsö S. Koster 60—120 fms. (Auriwillius).

Norway. Drontheim fiord. Skarnsund 100—220 m in dead *Lophohelia* and *Paragorgia* (Oestergren, Mortensen 1911), Rödberg 150—200 m (Oestergren and Arwidsson) 100 fms. on "*Duva rosea*" 200—400 m (Arndt). Mosterhavn 150 fms. on *Lophohelia*, Selsövig 100 fms. (G. O. Sars). Finmark. North Cape on a *Brisinga* 350 fms.

Exterior aspect: The body is extended and more or less irregularly curved, because the animal commonly lives in the dead calyces of *Lophohelia*. No physa is developed, the proximal end now broad, now pointed. The scapus is invested with a firm, very thick, almost coriaceous, irregularly folded cuticle, not equally wide, but here and there irregularly thickened, sometimes thicker than the capitulum, and in the distal part sometimes with 8 pronounced longitudinal furrows (Pl. 1, fig. 33), corresponding to the insertions of the mesenteries. These furrows are prolonged downwards, but becoming less distinct. The cuticle of the scapus is easily deciduous, in the distal part often thinner than in the proximal part. The capitulum shows 8 high ridges, each placed midway between two insertions of the mesenteries. If the capitulum is strongly contracted, the ridges appear like distinctly outlined, folded ribbons (Carlgren 1893, Pl. 1, fig. 8). The most distal part of the capitulum is thinner than the other part of it. The tentacles are between 30—40 in number, in younger specimens fewer, hexamerously arranged, in three or four cycles, short, cylindrical; the inner tentacles a little longer than the outer ones. The oral disc is small, with radial furrows corresponding to the insertions of the mesenteries. The actinopharynx is short, with 8 longitudinal ridges and as many longitudinal furrows. The siphonoglyphe is ventral, indistinct, about twice the breadth of the other longitudinal furrows in the actinopharynx.

Anatomical description: The scapus-ectoderm is high, especially in the proximal part and on the ridges, and several times thicker than the mesogloea; also in the distal parts it is higher than the mesogloea. The nematocysts are few in number between the ridges, on these latter very numerous but scattered and do not seem to form any such groups as in *M. carnea*. They are most frequently a little curved, with rather indistinct basal part to the spiral thread which follows the whole length of the capsules, and they are 36—48 × 6 μ in size. Further down there are also smaller capsules, about 24 μ long. The cuticle of the scapus is very thick, the outer part of it is rather easily loosened from the underlying, thinner substitutive-cuticle, and is a little incrustated. The ectoderm of the capitulum is in the ridges high, with numerous nematocysts, 22—30 μ long and 4 μ broad; in the furrows lower, with very few nematocysts (textfig. 75). The mesogloea is much thicker on the ridges than in the furrows, where it is rather thin. The endodermal circular muscles are weak and form no sphincter. The ectoderm of the tentacles contains very numerous nematocysts, about 22 × 4 μ in size, and spirocysts of variable length; the largest are of about the same size as the nematocysts. The ectoderm of the actinopharynx is high on the ridges and many times higher than the mesogloea, with comparatively rare nematocysts, partly smaller, 17—19 μ long, partly larger, 24—29 × 3 μ, and numerous gland-cells. The nematocysts are mainly arranged on the ridges; in the furrows they are very few. The siphonoglyphe is only a little differentiated from the other part af the actinopharynx. The mesogloea is a little thickened on the insertions of the mesenteries and ends in a thin lamella.

Fig. 73.

Fig. 74.

Fig. 75.

Textfigs. 73—75.
Milne-Edwardsia loveni.
Fig. 73. Transverse section of pennon in the upper part of the reproductive tract.
Fig. 74. Transverse section of a portion of capitulum with a parietal muscle.
Fig. 75. Transverse section of a portion of the capitulum *n*: nematocysts.

The weak, imperfect mesenteries are rather thick. The longitudinal pennons of the 8 perfect mesenteries are in the reproductive region provided with 20 to 30 folds which are of about equal height and rather much ramificated (textfig. 73). The outer lamellar part of the mesenteries issues very close by the outer edge of the pennons. The parietal muscles (textfigs. 74, 75) are well developed, with thin folds of a characteristic appearance. They appear fan-shaped on transverse-sections; the lamellar part of the mesenteries issues from the base of the fan. The ciliated streaks are present, though not long. The animal is dioecious.

Biology: The animals live in dead coral-branches of *Lophohelia* and *Paragorgia*, sometimes on other Octo-corals or on *Brisinga*. In contradistinction to the genus *Edwardsia* they do not show any reactions to light or to shade.

Remarks: This species has before been described by me in detail (1893, p. 17); I have here completed the description mainly with regard to the stinging capsules. Concerning further details I refer to this work.

Milne-Edwardsia carnea (Gosse) Carlgr.

Edwardsia carnea n. sp. Gosse 1856, p. 219. Pl. 9, figs. 1—4.

— — Gosse, Gosse 1858, p. 418, Gosse 1860, p. 259, Pl. 7, figs. 5—6, Pl. 12, fig. 3, Hincks 1861, p. 363, Haddon 1889, p. 328, Pl. 33, fig. 15, Pl. 36, figs. 5—6. Bourne 1916, p. 25, textfig. 2.

Edwardsiella — — Andres 1883, p. 99, Pennington 1885, p. 178.

Milne-Edwardsia — (Gosse) Carlgren 1892, p. 456, figs. 4—6.

Diagnosis: Real physa absent. The proximal part of the animal can, however, serve as a sort of physa when the cuticle is loosened. Scapus not polygonal, with a rather well-developed, easily deciduous cuticle. The ectoderm of the scapus with nematocysts mainly arranged in larger and smaller groups, its nematocysts 29—34 (37) × 7—8 μ. Capitulum distinctly polygonal, the ridges however not as high as in *M. loveni*. Nematocysts of the capitular ectoderm 26—46 × 7 μ, those of the tentacles partly 18—24 × 5 μ, partly 27 × 7 μ. Number of tentacles from about 18 to 32. Nematocysts of the actinopharynx partly typical, 17—20 × 3 μ, partly so, with distinct basal part to the spiral thread 22—29 × 5 μ. Longitudinal muscle-pennons weaker than in *M. loveni*; in the reproductive regions commonly with only 12 folds and never more than 20.

Colour: Cuticle of the scapus brownish-yellow. "Physa" and scapus rose-red. Capitulum translucent, flesh-coulored. Each capitular ridge has a fine line of opaque white or light pale-yellow with a dilute spot of the same colour near the base. Tentacles translucent, flesh-coloured, sometimes with alternate bands of stronger colour, often pale opaque-yellow at the base. This colour forms a spot on each side of the tentacles. Oral disc transparent with a cream-coloured star. Mouth as well as actinopharynx scarlet-red (Gosse) — Cuticle of the scapus dirtily yellowish-brown. Capitulum, scapus and "physa" flesh-coloured, translucent. Capitulum has on the middle or a little below a more or less opaque white annulus of rectangular spots, separated by a small flesh-coloured part from the pale whitish insertions of the mesenteries. These spots are sometimes prolongated as very pale lines on the rather strong capitular ridges, Tentacles flesh-coloured with a little tinge of rose-colour, especially conspicuous when the tentacles are contracted. The outer part of the oral disc is opaque white shading off into yellowish-white; the colour also expands to the middle part of the tentacles as a narrow tongue-shaped spot with the point facing towards the end of the tentacles, and between the tentacles as narrow lines. The inner part of the oral disc is scarlet-red with opaque white streaks. Actinopharynx scarlet-red. Reproductive organs and filaments orange-coloured (Carlgren).

Dimensions: Length of the column 2,5 cm., breadth 0,2 cm (Gosse). A small, expanded specimen shows the following dimensions: Length of the column 1,5 cm, breadth 0,25 cm, length of the tentacles about 0,25 cm (Carlgren).

Occurrence: Sweden, Bohuslän: Gullmarfiord. Flatholmen on the base of *Alcyonium*-colonies (Carlgren), Smedjebrotten on stones overgrown with *Sertularia* (Carlgren), Valbyfiord on the base of *Alcyonium*-colonies (Aurivillius).

Further distribution. S.W. Coast of England. Petit Tor and Orestone in the vicinity of Torquay. South Devon: Tenby South Wales, in the ebb-zone in cavities bored by Saxicava. Plymouth.

Exterior aspect: The body is extended, almost cylindrical and divisible into two regions, scapus and capitulum. Gosse states that a well developed physa is also present. I formerly (1892) adopted this opinion, mainly on basis of the description by Gosse. This so-called physa is, however, — as I afterwards have found out — to be interpreted otherwise, and the more so as also Gosse mentions that the most proximal part of it is sometimes furnished with a cuticle. If we more closely examine the figure of Gosse (1856, Pl. 9, figs. 1, 4) which was to represent the animal with expanded physa, we find that the scapus-cuticle, above the cuticle-lacking most proximal part, forms some distinct, tranversal folds. The presence of these strong folds does not indicate a normal appearance of the proximal body-end, but is rather to be interpreted thus that the "physa" (the most proximal body-end) is not turned out, but the cuticle is in this part loosened and pushed upwards, whereby the above-mentioned folds are formed. The observations of these species, made by me during a long stay at the zoological station of Kristineberg, unmistakably prove this to be the case. The thing is that the animal very easily casts off its scapus-cuticle. This unfastening of the cuticle takes place most easily and frequently in the most proximal part which is mostly in contact with foreign bodies. A physa, at least in the proper sense of the word, therefore, to my mind, does not exist. Besides this, the proximal body-end may expand more or less disc-like when the animal has cast off the cuticle. The above-mentioned specimen altered its form during the time of observation in such a way that, instead of forming a prolongated cylinder, it formed a low cone with enlarged base, attached to the glass. The cuticle of the scapus is rugous, of ordinary thickness and not incrusted. Also the distal part of the scapus-cuticle is loosely connected with the ectoderm of the scapus and forms an almost totally free tube into which the distal part of the animal can be drawn. Consequently the animal is able to contract much more than *M. loveni*. The capitulum is short, without a cuticle, distinctly polygonal and with 8 rather strong, longitudinal ridges which are, however, not as conspicuous as in *M. loveni*. The tentacles are 18—32 in number, the largest number observed by Gosse was 28, by Bourne 32, I have not found any more than 26 myself. According to Gosse the arrangement should be 8 + 8 + 12, in fact they are arranged hexamerously as in *M. loveni* (6 + 6 etc.) in three or four cycles of which the fourth is very incomplete. The tentacles are short, the inner longer than the outer ones. The oral disc is small, with distinct radii. The mouth is placed on a high cone. The actinopharynx is short, with 8 longitudinal ridges and just as many longitudinal furrows. Whether a small ventral siphonoglyphe is present I cannot determine with certainty as the examined specimens were not in every respect well preserved. Probably a siphonoglyphe is present here as in *M. loveni*.

Anatomical description: The ectoderm of the scapus is high, thicker than the mesogloea and contains nematocysts, 29—34 (37) × 7—8 μ in size, often somewhat curved, and large, very numerous gland-cells. The nematocysts are packed together in greater and smaller groups; there are, however, also a few nematocysts between the groups. The ectoderm of the capitulum is in the longitudinal ridges very high (textfig. 79), a little thicker than the mesogloea, but in the furrows thinner. In the ectoderm of the ridges there are numerous nematocysts, 26—46 μ long and almost 7 μ broad, often a little curved, while the ectoderm of the furrows does not contain any such. The mesogloea is thickened in the ridges. The ectoderm of the tentacles is provided with very numerous, smaller nematocysts (18—24 × 5 μ) and some few, a little larger (27 × 7 μ). The spirocysts are of variable size, the largest about 24 μ long. The ectoderm of the actinopharynx is high in the ridges as on the capitulum; in the furrows thinner and provided with numerous, granulate gland-cells. Mainly in the ridges typical nematocysts are found (17—20 × 3 μ) and some such with distinct basal part to the spiral thread and a little broader in the basal end (22—29 × 5 μ. In the probably differentiated siphonoglyphe the gland-cells and spirocysts are few in numbers.

Fig. 76.

Fig. 77.

Fig. 78.

Fig. 79.

Milne-Edwardsia carnea. Fig. 76 Transverse section through a portion of scapus in the reproductive tract. Figs. 77—78. Transverse sections of pennons in the reproductive tract. Fig. 79. Transverse section of a portion of the capitulum, *n*: nematocysts, *me*: mesentery.

The imperfect mesenteries in the most distal part of the body are considerably weaker than in *M. loveni*. The perfect, well-developed mesenteries are as usual in the Edwardsiidae 8 in number, in a specimen I have, however, found only 7 stronger mesenteries and 7 ridges in the actinopharynx (compare the similar discovery by Levander in "*Edwardsia carnea*" = *Paraedwardsia sarsii?*). The folds of the longitudinal pennons are comparatively few in the reproductive region, ordinarily high and only a little ramificated, commonly 12 in number, sometimes many, but never more than 20. The lamellar outer part of the mesenteries issues not far from the outer edge of the pennons (textfigs. 77, 78). The parietal muscles (textfig. 76) are in the capitular region very strong, in transverse-sections triangular or rather fan-shaped, they recall those of *M. loveni*, though they are not as richly folded; in the reproductive region they are a little weaker. Their expansion on the column is not considerable in the most distal part, in the reproductive organs they are a little more expanded, though only as far as to half their breadth. The ciliated streaks are well developed, just as well as the intermediate streaks. The animal is dioecious.

Biology: According to my observations this species as well as *M. loveni* are not sensitive to the effect of light. The animal when kept in an aquarium easily throws off its scapus-cuticle, and thereafter wanders about by means of its proximal end which thus becomes flattened, disc-like (compare above). It can besides attach itself by the sides of its body. The suckers which, according to Gosse, should be found in this species are, however, not present, neither are the "*Halcampa*-papillae", characteristic of *Paraedwardsia*. The attachment which is, however, never firm, is performed exclusively by the secretion of the numerous gland-cells. The animal successively forms a new cuticle. On the biology of this animal Gosse (1860) moreover gives several informations.

Remarks: Haddon (1889) has reproduced some figures of this species. The habitus-figure (Pl. 33, fig. 15) represents a rather badly preserved specimen, the cuticle of which is for the greater part peeled off. Of the anatomical figures of the species only one, showing the parietal muscles, is of use to the identification which I can determine by a study of Haddon's sections. Though I have not been able to make more exact measurements of the stinging capsules I have, however, ascertained that the nematocysts of the scapus of Haddon's specimens were of the same appearance as those of the Swedish representative of the species, and arranged in groups. The Swedish form is also identical with the British one; on the other hand, the species which Appellöf (1893) has described as *E. carnea* is a *Paraedwardsia* (compare *P. sarsii*). Gosse's figures of the species are rather good, especially the uncoloured ones. I have myself reproduced some figures of anatomical details, one of these is here once more reproduced.

Milne-Edwardsia polaris n. sp.

Diagnosis: The most proximal part of the body without cuticle, physa-like. Scapus with rather feebly developed cuticle, with comparatively few nematocysts (14—22 × 2, 5—3.5 μ), arranged in groups which sometimes are placed in shallow sinkings in the mesogloea. Capitulum polygonal. Its ectoderm with nematocysts, 14—17 μ long. Tentacles 12. The ectoderm of the tentacles with comparatively few spirocysts, 12—19 μ long, and nematocysts, 15—22 × 2,5 μ in size. Nematocysts in the ectoderm of the actinopharynx numerous, 16—24 × 2, 5—3 μ. Longitudinal muscle-pennons of the mesenteries in transverse-sections through the upper part of the reproductive region with about 12—15 folds, branched in the outer parts of the pennons and sometimes also a little in the inner parts. The outer parts of the mesenteries issue not far from the outer side of the pennons. Parietal muscles somewhat feeble, with a few, sometimes rather thick folds. The parietal muscles are considerably expanded on the column.

Colour: in alcohol: Scapus ochreous-yellow or dirtily-yellow.

Dimensions in contracted state: length to about 1,5 cm, breadth to about 0,5 cm.

Occurrence: East-Greenland. Fame Isl. Scoresby Sound 70°50′ N. 22°33′ W. 5—8 m mud (Sw. Greenl.-Exp. 1899, N. 31, 2 sp.).

East Spitzbergen King Charles Land. Jena Isl. at N.E. Cape about half a league from land, in front of a great glacier. Coarse-grained, blue clay with a few, small stones. 36 m (Roemer & Schaudinn 1898, St. 31, 1 sp.).

West-Spitzbergen, Ice-fiord, Temple bay, 43—45 m. Compact, greyish-red clay.

Temp. at the bottom 2,5° (Sw. Spitzb.-Exp. 1908, St. 51, 2 sp.) Temple bay, Biona's haven, 30 m. Compact greyish-red clay with stones. Temp. at the bottom 3,78° (Sw. Spitzb.-Exp. 1908, St. 56, 2 sp.). Spitzbergen without distinct locality (Sw. Spitzb.-Exp. 1898).

Exterior aspect: The physa, if present, is small, in as much as only the most proximal part of the column is devoid of a cuticle. On the scapus there are 8 shallow, longitudinal furrows, corresponding to the insertions of the mesenteries and particularly distinct in the distal part. In contracted state of the animal the involved part of the scapus is polygonal. The cuticle of the scapus is, in comparison with the other *Milne-Edwardsia*-species, feebly developed and sometimes here and there lost. In the specimen collected by Roemer and Schaudinn there are fragments of yellowish-brown particles and small grains of sand sticking to the undermost part of the scapus. I have not been able to observe any of the "*Halcampa*-papillae" which exist in the genus *Paraedwardsia*, and therefore the gland-cells have probably served as organs of attachment. The capitulum is short, in the proximal part polygonal, in the distal part in transverse-sections more round. Probably this difference is due to a various state of contraction of the different parts. The tentacles are not more than 12, on one specimen I observed that the two tentacles projecting from the ventro-lateral compartments are smaller than the others. The oral disc is inconsiderable, the actinopharynx is short and furnished with 8 longitudinal ridges at the insertions of the mesenteries; between the ridges there are deep longitudinal furrows. An indication of a ventral siphonoglyphe seems to be found (the specimens were, however, not so well preserved that I can state this with certainty).

Fig. 81.

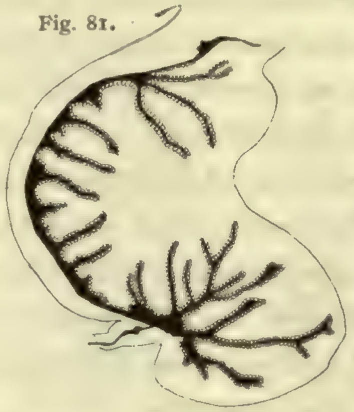


Fig. 80.

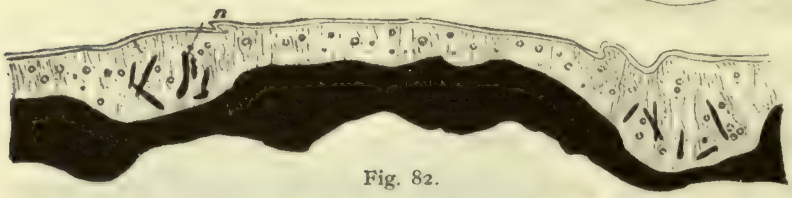


Fig. 82.

Textfig. 80—82. *Milne-Edwardsia polaris.*
Fig. 80: Transverse section of a parietal muscle in the upper part of the glandular tract. Fig. 81: Transverse section of a pennon in the same tract. Fig. 82: Section of scapus with groups of nematocysts *(n)*.

Anatomical description: The ectoderm of the scapus is now thin, now more thick, especially in the parts containing nematocysts. The cuticle is weak, especially in comparison with that of *M. loveni* and *carnea*. The nematocysts which in the scapus-ectoderm reach a size of (14) 17—22 × 2, 5—3 (3,5) μ are here a little numerous and packed together in groups, scattered between the insertions of the mesenteries and, on account of the thickening of the ectoderm, sometimes sunk a little down in the mesogloea (textfig. 82). The mesogloea is of about the same thickness as the ectoderm, the endoderm is however thinner. The high ectoderm of the capitulum contains nematocysts, 14—17 μ long, arranged on the ridges. In the parts of the involved capitulum which are the most closely pressed together the mesogloea forms high ridges between the insertions of the mesenteries, in the other parts the mesogloea is more equally thick. The nematocysts of the tentacles reach a size of 15—22 × 2,5 μ, the spirocysts are about 12—19 μ long. The high ectoderm in the actinopharynx-ridges contains nematocysts, 16—24×2,5—3 μ in size. The mesogloea of the actinopharynx is thin, still a little thickened in the ridges.

The longitudinal pennons of the mesenteries are rather well developed, with about 13 to 15 folds in the regions of the ciliated streaks and of the reproductive organs. The folds are in the inner and especially in the outer parts very little ramificated and high, while in the middle of the pennons they are short and not branched (textfig. 81). The outer lamellar part of the mesenteries issues from the pennons rather close by the outside. The parietal muscles are not strong, with a few, short, broad folds, supported by thickenings of the mesogloea; on the other hand they are considerably expanded on the column (textfig. 80). The filaments of the mesenteries were badly preserved, so that I cannot give any information of their appearance. The animal is dioecious.

Remarks: This species is rather interesting, as in some respects, concerning the arrangement of the nematocysts, it may be regarded as a previous stadium of the genus *Edwardsia*. If we imagine the nematocysts and their mother-cells in the column of *M. polaris* to be wholly enclosed in the mesogloea and the supporting cells reduced, we have a nemathybome. The genus *Edwardsia* cannot, however, directly descend from *Milne-Edwardsia*, because the arrangement of the tentacles in *Edwardsia*, compared with that of *Milne-Edwardsia*, shows that both genera are developed, each in its own direction.

Milne-Edwardsia nathorstii n. sp.

Diagnosis: Proximal end rounded without distinct physa. Scapus with a well developed cuticle. Nematocysts of the scapus-ectoderm concentrated in small groups containing only some few capsules, 29—36 × 3,5—5 μ in size. Tentacles 12. Their ectoderm with very close spirocysts of variable size, the greatest spirocysts reach a size of 34—36 × 5 μ. Nematocysts in the ectoderm of the tentacles not numerous, 31—36 × 3,5—5 μ. Nematocysts of the actinopharynx 34—36 × 5 μ. Longitudinal muscle-pennons of the mesenteries in transverse-sections through the upper part of the reproductive region with some few, about 10, low folds, supplied with short, secondary folds. The lamellar outer parts of the mesenteries issue not far from the middle of the pennons. Parietal muscles not strong, with rather few folds, but they are considerably expanded on the column, where they have comparatively high folds.

Colour in alcohol: Scapus dirtily-yellow.

Dimensions in contracted state: Length of the column about 1 cm, breadth 0,15 cm.

Occurrence: East-Greenland. Scoresby Sound, Hurry's Inlet, 70°43′ N. 22°29′ W. 30 m mud (Sw. Greenl. Exp. 1899, N. 455, 456) 9 sp.
N. of Spitzbergen 81°20′ N. 20°30′ E. 1000 m (Roemer & Schaudinn, 1898, St. 41) 1 sp.

Exterior aspect: As all specimens were contracted, with the distal part involved, and only of small size, I cannot give any complete information of the exterior of the species. The description is made after an examination of the specimens from Greenland.

The proximal part is rounded and fusing into the middle without distinct outline. No distinct physa is present. The scapus is provided with a sometimes thin, sometimes thick, but translucent, often irregularly wrinkled cuticle, to the outside of which small grains and a great number of detritus-particles are attached. Under low magnifying powers small papilliform elevations are to be seen, which are, however, not regularly arranged, they are as yet only thickenings of the ectoderm as may easily be ascertained on sections (textfig. 83). The capitulum is short, not thickened between the insertions of the mesenteries. The tentacles are 12 in number, probably arranged in two cycles; the oral disc is inconsiderable. The actinopharynx is short and furnished with 8 longitudinal ridges. Whether a ventral siphonoglyphe is present or not I cannot decide with certainty.

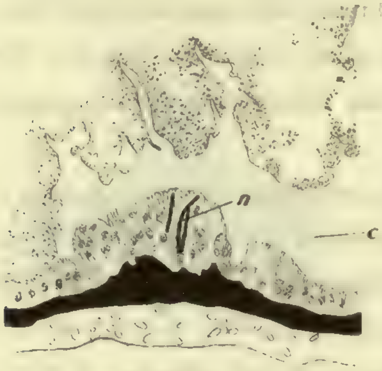


Fig. 83.

Fig. 85.

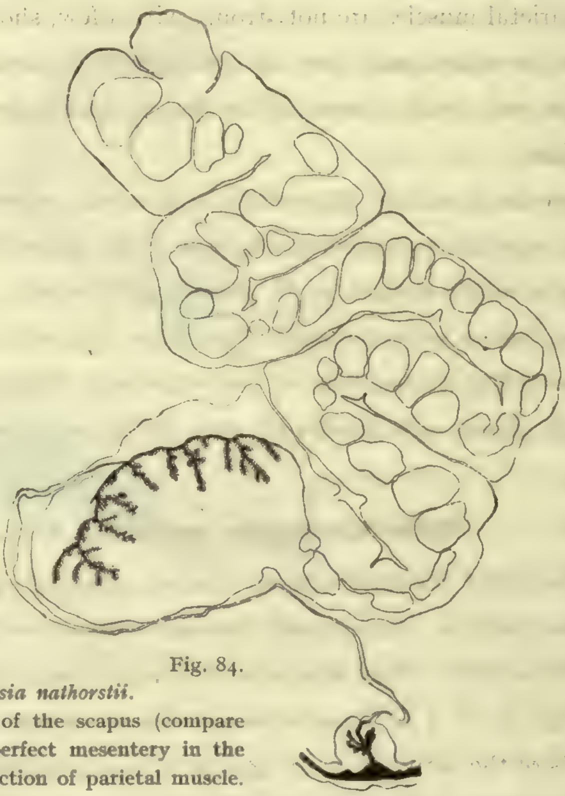


Fig. 84.

Textfigs. 83—85. *Milne-Edwardsia nathorstii.*
Fig. 83: Transverse Section of a portion of the scapus (compare text!). Fig. 84: Transverse section of a perfect mesentery in the reproductive tract. Fig. 85: Transverse section of parietal muscle.

Anatomical description: The scapus-ectoderm is as a rule not high, here and there it is, however, thickened, cushion-like. In these thickenings the nematocysts are accumulated (textfig. 83 *n*). They are, however, not numerous, but the groups still must be regarded as weak batteries of nematocysts. The size of the nematocysts is 29—36 × 3,5 —5 μ. The scapus is covered with a folded cuticle, now thin, now thick. If the cuticle (textfig. 83 *c*) is thick, it resembles the same layer in *Isoedwardsia;* it is only a little stained, or not at all so, with borax-carmine which is easily absorbed by the mesogloea. The mesogloea is thinner than the ectoderm. In the endoderm of the column I have observed large nematocysts. Whether these latter are normal components of the endoderm I cannot with certainty decide. The circular muscles of the column are weak. The ectoderm of the capitulum is thicker than the mesogloea. The ectoderm of the tentacles is high and contains very numerous, closely packed spirocysts of variable size. The largest are of the same kind as those of the column, but more sparse and 34—36 × 3,5—5 μ in size. The ectoderm of the actinopharynx is high in the ridges; the rather numerous nematocysts show a distinct basal part to the spiral thread and reach a size of 34—36 × 3,5—5 μ.

The number of the mesenteries is 12 of which only 4 are weak off-shoots in the most distal part. The longitudinal muscle-pennons of the 8 "*Edwardsia*-mesenteries" are not strong in the reproductive region and show in transverse-sections about 10 low folds, all of about equal height or gradually shortened in the inner parts, and provided with secondary branches. The lamellar part of the mesenteries issues from about the middle of the pennon (textfig. 84). The endoderm of the pennons is high between the actinopharynx and the reproductive region, with numerous vacuoles on the side where the folds are; on the opposite side, however, it has no such vacuoles, but densely packed nuclei. The parietal muscles (textfig. 85) expand rather far on the column in the reproductive region and still farther in the distal end of the column (textfig. 85). The filaments are of usual appearance, the ciliated streaks short. The animal is dioecious. One examined species was a male, another a female. The nematocysts in the ectoderm of the scapus of the specimen, taken by Roemer and Schaudinn, were a little smaller (24—27 × 3,5—4,5 μ) than those of the type-specimens. As far as I can see from the structure of the badly preserved specimen it belongs to *M. nathorstii*. The longitudinal pennons and the parietal muscles are of the same appearance as those of the type.

Genus **Paraedwardsia** Carlgr.

Diagnosis: Milne-Edwardsiinae with no physa or only a weakly developed one. Scapus with a more or less well developed cuticle and with scattered "*Halcampa*-papillae". Nematocysts of the scapus-ectoderm scattered, with a tendency to arrange themselves in groups; they are comparatively broad, in proportion to their length. Nematocysts of the scapus and of the capitulum of about the same size. Inner tentacles longer than the outer ones, now hexamerously, now octomerously(?) arranged. A weak ventral siphonoglyphe present (always?).

This genus which was characterized by myself in a few words in 1905 is distinguished from the nearly related *Milne-Edwardsia* by having on the scapus "*Halcampa*-papillae" which are absent in *Milne-Edwardsia*. Concerning the structure of these papillae, also occurring in other Actiniaria-genera, I refer to the genus *Halcampa*. Whether the tentacles always are arranged hexamerously I cannot confirm. In the type *P. arenaria* the number of the tentacles appears to be 16, but whether they are arranged 6 + 6 + 4 or 8 + 8 is difficult to decide as the state of preservation of the tentacles was not good. Probably the tentacles of this species are distributed according to the latter type. It also remains to verify the presence of a ventral siphonoglyphe in this species. *P. sarsii* (Düb. & Koren) belongs to this genus besides the type *P. arenaria* Carlgr.

Paraedwardsia arenaria Carlgr.

Pl. 1. Fig. 15, 16.

Paraedwardsia arenaria n. sp. Carlgren in Nordgaard 1905, p. 158.

Diagnosis: No distinct physa. The most proximal part of the body, however, probably without "*Halcampa*-papillae. Scapus with a somewhat thick cuticle? (periderm) and with scattered "*Halcampa*-papillae" to which grains of sand are attached. Ectoderm of the scapus with scattered nematocysts partly 17—22 × 3 μ, partly 26—29 × 4 μ. Nematocysts in the capitular ectoderm partly 14 × 2 μ, partly about 24 × 2,5 μ. Capitulum and scapus in preserved state with 8 indistinct longitudinal furrows. Tentacles 16, probably in two cycles. Nematocysts of the tentacles about 24 × 2 μ, spirocysts to about 28—40 μ long. Nematocysts of the actinopharynx partly 20—22 × 2 μ, partly 31—36 × 3 μ. Longitudinal muscle-pennons of the mesenteries in transverse-sections rather elongated with about 25—30, somewhat richly ramificated folds in the inner and especially in the outer parts. Inner folds of about equal height, considerably lower than the outer folds. Lamellar outer parts of the mesenteries attached to the outer part of the pennons. Parietal muscles well developed, recalling two fans, one on each side of the main-lamella of the mesogloea. The expansion of the parietal muscles on the column the ordinary one.

Colour in preserved state: the specimens from the Gunhild-Expedition and from Skierstad have an ochreous-yellow scapus with deep black, in the proximal part very numerous grains, which are so densely packed that they almost completely cover the yellow periderm. The scapus of the Bergen-specimen is dirtily-ochreous-yellow; the capitulum and the tentacles are slate-gray.

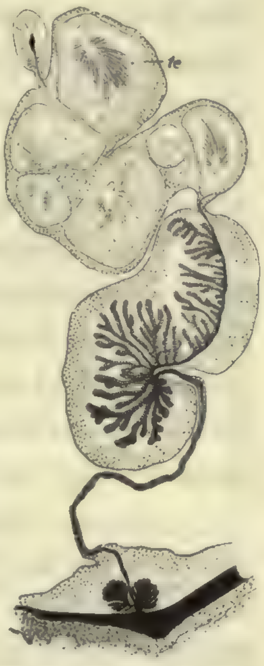
Dimensions in preserved state: 1) One Gunhild-specimen (Pl. 1, fig. 15). Length 3,6 cm, largest breadth 0,5 cm. The other Gunhild-specimen: Length 3,3 cm, largest breadth 0,8 cm. Bergen-specimen 1: Length almost 3 cm, largest breadth, a little above the proximal end, 0,5 cm. Length of the tentacles in expanded, preserved state 0,3—0,35 cm. Bergen-specimen 2: Length almost 2 cm, largest breadth 0,3 cm.

Occurrence: Norway. Finmarken. Skierstadfiord 330 m (Nordgaard 1900 2 sp.). Herlöfiord 130 fms. (Appellöf 2 sp.), 9 miles N. of Jäderen 140 fms (G. O. Sars 1 sp.). Skagerrak 370 fms. clay (Gunhild-Expdition 1879, St. 10, 2 sp.).

Exterior aspect: A distinct physa seems to be absent. True enough the proximal end is a little different in appearance from the other part of the scapus, but the presence of fragments of a periderm in the most proximal part (Pl. 1, fig. 16) of a Gunhild-specimen indicates that we not have to do with such a regular physa as that of the genus *Edwardsia*. The periderm of the most proximal part of the body seems, however, to be very easily dropped, and the "*Halcampa*-papillae" are probably absent, or at least so sparse that this part appears as having no papillae. A distinct boundary line between the most proximal part and the other part of the scapus is, however, not to be seen. Excepting the most distal part of the scapus, where the papillae are sparse, these latter are found in great numbers on the other part of the scapus (Pl. 1, fig. 15). To the papillae numerous grains of sand are attached, as in *Halcampa*. Besides this the scapus is covered with a yellowish, rather thin periderm, possibly formed only by a stiffened product of the secretion of the gland-cells. Whether there is a regular cuticle I cannot with certainty decide, I have therefore used the vaguer term of periderm here. The capitulum is short, smooth, without a cuticle and with translucent insertions of the mesenteries. In the contracted state of the animal, longitudinal furrows, corresponding to these insertions, are visible in the capitular region, as well as in the proximal part of the body. The number of tentacles is 16, probably arranged 8 + 8. They are rather long and conical. Whether the inner tentacles are longer than the outer ones I cannot with certainty decide, but it is possible that it is so. The difference between the sizes of the tentacles in the two cycles is, at any rate, inconsiderable. The oral disc is small, the actinopharynx short and furnished with longitudinal furrows. Whether a ventral siphonoglyphe is present is doubtful, the sectioned specimens were not well preserved, as regards the actinopharynx.

Anatomical descriptions: The most proximal part of the body is provided with a high ectoderm, containing numerous gland-cells and nematocysts, partly smaller, about 17—19 μ, partly larger, about 24—26 μ. The ectoderm of the scapus is rather high, with numerous, scattered, typical nematocysts, partly smaller, 17—22 × 3 μ, partly larger, 26—29 × 4 μ. In the papillae which show the same structure as those of *Halcampa*, the ectoderm is low, and the cells of another structure than that of the other parts (compare the family Halcampidae). The scapus hardly seems to form a regular cuticle, but by the secretion of the gland-cells particles of mud and foreign bodies are glued together so as to form a thin membrane, covering he scapus (compare above!). The mesogloea is stratified, of ordinary thickness and sometimes tapering into papilliform off-shoots. When the scapus is expanded the "*Halcampa*-papillae" are not distinct, and their position is only indicated by their structure which is different from that of the other parts of the scapus. The scapus-endoderm is of about the same thickness as that of the ectoderm. The capitular ectoderm is high, higher than the mesogloea and contains numerous nematocysts, partly larger 24 × 2,5 μ, partly smaller about 14 × 2 μ. On maceration-preparations of the capitulum I have also observed spirocysts. As, however, I did not find any spirocysts on sections through the same region, it is probable that the spirocysts belonged to the tentacles, and were stuck to the capitulum which is invaginated with the tentacles. The mesogloea of the capitulum is more fully developed in the middle of the compartments than on their sides. The ectoderm of the tentacles contains numerous nematocysts, 24 μ long and 2 μ broad, and very numerous spirocysts of a length of unto 28—40 μ. The high ectoderm of the actinopharynx is furnished with numerous nematocysts, partly larger, about 31—36 × 3 μ, partly smaller, 20—22 × 2 μ.

The 8 imperfect mesenteries are short and thick. The longitudinal muscle-pennons on the 8 perfect "*Edwardsia* mesenteries" appear rather elongated on transverse-sections in the reproductive region (textfig. 86) and with about 25 to 30 folds. These latter are rather much ramificated, especially in the outer parts. The more central folds are of almost equal height and considerably lower than the folds nearer to the outside. In the region of the ciliated streaks and off the actinopharynx the folds are lower and more concentrated. The parietal muscles are well developed (textfig. 86) with several folds of fan-shaped appearance on each side of the main-lamella of the mesogloea. The parietal muscles are rather considerably expanded on the column, but they do not reach as far as the parietal muscle-pennons extend. The ciliated streaks, the streaks between these latter, and the middle streak are well developed. In the lower parts of the filaments there are also boundary streaks, furnished with vacuoles along their outside. The animal is dioecious. Two specimens, examined more in detail, were males (Textfig. 86 *te:* testes).



Textfig. 86. *Paraedwardsia arenaria*. Transverse section of mesentery.

The anatomical description of this species is principally based on the specimens from the Gunhild-Expedition.

Paraedwardsia sarsii (Düb. & Koren) Carlgr.

Pl. 1. Figs. 8, 9. Pl. 4. Fig. 7.

?*Lecythia brevicornis* n. sp. M. Sars 1829, p. 27, Pl. 1, fig. 10.

? — — Sars, Sars 1833, p. 226, Pl. 10, fig. 5, 1835, p. 3, Ehrenberg 1834, p. 73.

Edwardsia sarsii Düb. Düben and Koren 1847, p. 267.

Edwardsiella sarsii Sars, Andres 1883, p. 101.
?*Edwardsia carnea* Gosse, Levander 1892, p. 292, fig.
Edwardsia carnea Gosse, Appellöf 1893, p. 4, Pl. 1, Pl. 2, figs. 6—9, Pl. 3, figs. 12—18, 20—23, 1895, p. 7, 11. Grieg 1897, p. 4, 9, 12.
Milne-Edwardsia carnea Grieg 1913, p. 143.

Diagnosis: A small, not vesicular, physa present. Scapus-circumference round, with distinct longitudinal furrows, but with a thin periderm, scattered "*Halcampa*-papillae" and scattered nematocysts partly 17—22 × 3,5—4,5 μ, partly 8—12 μ long. Capitulum polygonal with 8 rather distinct longitudinal ridges and with nematocysts partly smaller, 10—14 × 1,5—2 μ, partly larger, about 24 μ in size. Tentacles from 20 to more than 30, the inner ones longer than the outer ones and hexamerously arranged, with nematocysts 19—22 × 2 μ and spirocysts to about 28 × 5 μ in size, in the ectoderm. Typical nematocysts in the ectoderm of the actinopharynx partly 14—22 × 1,5—2 μ, partly 24—29 × 2,5—3,5 μ, besides nematocysts with distinct basal part to the spiral thread 22—24 × 3,5—5 μ in size. A hardly differentiated ventral siphonoglyphe. Nematocysts in the endoderm of the column, tentacles, and actinopharynx numerous, 34—43 × 5 μ. Longitudinal pennons of the mesenteries in the reproductive regions on transverse-sections rather elongated with about 15—20 somewhat ramificated folds. Inner folds of rather equal height, considerably lower than the outer folds. The lamellar part of the mesenteries attached to the outer part of the pennons. Parietal muscles in the reproductive region well developed, rather richly ramificated and on transverse-sections of a rounded appearance, in the other parts considerably weaker and arranged more in the shape of a fan. The parietal muscles are considerably expanded on the column.

Colour: Physa uncoloured. Scapus brownish-yellow. Capitulum and tentacles translucent, uncoloured. Oral disc and actinopharynx red (Appellöf 1893). According to Sars (1829) the colour of his *Lecythia brevicornis* was: Scapus dirtily-green, opaque. Capitulum and tentacles hyaline, shading off into pale red. Mouth and actinopharynx dark red.

Dimensions: Length to 3,5 cm, breadth 0,3 cm (Appellöf). Length of *Lecythia* about 0,8 cm (Sars).

Occurrence: Norway. Bergen on *Saxicava pholadis* (*Lecythia* M. Sars) Bergen, Manger (M. Sars, Schaudinn). Radöfiord N. of Bergen, Alvarströmmen Bergen 30—40 fms. sand and mud (Appellöf). Hardanger fiord. Straumastein 100—200 m, Eikevik 50—150 m (teste Grieg). Herlöfiord, Dalstöbugten 6—12 fms. mud (Appellöf). Ulvesund Lestholmen, Skarebugten 60—100 m shelly sand mixed with clay (teste Grieg). Vaagsfiord Holnaesviken 40—100 fms. sand (teste Grieg). Vaagsfiord, Southern point of Skavöen to Tomberviken (teste Grieg). Korshavn (G. O. Sars).

Exterior aspect: The most proximal part of the animal is modified into a small, not ampullaceous, physa which is commonly involved, according to the statement of Appellöf. The scapus is on transverse-sections rounded, without longitudinal furrows, but with a thin periderm which is sometimes a little wrinkled on preserved specimens, on account of the contraction of the column. If the animal is wholly expanded the insertions of the mesenteries are visible (according to Appellöf). This author declares that the scapus is quite smooth. The scapus is in fact provided with scattered "*Halcampa*-papillae" to which small grains are sometimes attached in the proximal parts of the scapus (textfig. 87, Pl. 1, figs. 8, 9). The capitulum is polygonal and has 8 rather elevated longitudinal ridges between the insertions of the mesenteries. The tentacles of *Lecythia* are (according to Sars) 20, 25—26 in number, those of *carnea*, according to Appellöf, some 20 to some 30. I have observed 24—28 tentacles myself. The inner tentacles are longer than the outer ones, all short and of about the length of the capitulum, conical and hexamerously arranged in at least 3 cycles. Appellöf says that there are only 2 cycles of tentacles present. The oral disc is inconsiderable. The actinopharynx is short, with 8 longitudinal furrows and the same number of longitudinal ridges. A feebly developed ventral siphonoglyphe seems to be present.

Anatomical description: The physa is devoid of a periderm. The ectoderm contains numerous nematocysts, 8—15 μ long. The scapus-ectoderm is high and covered with a thin periderm. Its nematocysts are numerous and of two dimensions, partly comparatively broad 17—22 × 3,5—4 μ, partly smaller, thinner and about 8—12 μ long. The mesogloea is of about the thickness of the ectoderm or thinner and almost homogeneous. The endoderm is a little lower than the ectoderm and contains numerous nematocysts (text fig. 89, 92 *n*), 34—38 × 5 μ in size and often a little curved; these endodermal nematocysts make a characteristic feature of this species. I have observed such capsules also in the endoderm of the tentacles and of the actinopharynx. (Their size is 36—43 × 5 μ). The capitular ectoderm is high and provided with nematocysts which are smaller in the proximal parts (10—14 μ long), in the distal part, on the other hand, unto twice that length. In the furrows they are sparse, on the ridges numerous. According to Appellöf there are nerve-cells and nerve-fibrillae in the capitular ectoderm. The capitular ridges arise from the thickenings of the mesogloea. The ectoderm of the tentacles contains rather sparse nematocysts, 19—22 × 2 μ in size, and numerous spirocysts unto 28 × 5 μ in size. The ectoderm of the actinopharynx is high with scattered typical nematocysts partly smaller 14—22 × 1,5—2 μ, partly larger, 24—29 × 2,5—3,5 μ. Besides these, there are also nematocysts with distinct basal part to the spiral thread and somewhat broad in the basal end. Their size is 22—24 × 3,5—5 μ. The ectoderm of the siphonoglyphe is only a little differentiated from the other ectoderm of the actinopharynx, but it is provided with longer cilia than this part. Appellöf has not found any differentiation of the actinopharynx.

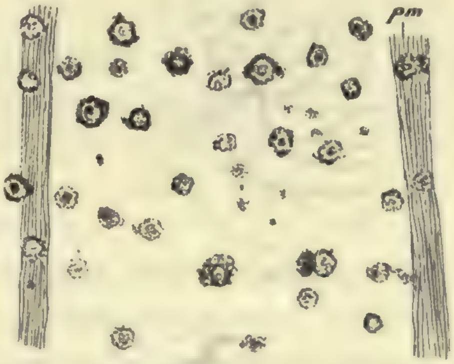


Fig. 87. *Paraedwardsia sarsii*. Arrangement of the "*Halcampa*-papillae" between two mesenteries. *pm*: parietal muscles.

The weak imperfect mesenteries in the most distal part are rather well developed. The longitudinal muscle-pennons of the 8 perfect "*Edwardsia*-mesenteries" are in the reproductive region provided with 15—20 folds (textfig. 88) which are a little ramificated, mainly in the outer part. The inner folds of the pennon are considerably lower than the outer ones, and the pennon itself, on transverse-sections, rather elongated in the reproductive region (textfig. 88). The lamellar outer parts of the mesenteries are attached to the pennon in its outer part. In the endoderm of the mesenteries large nematocysts of the same structure as those in the endoderm of the column here and there occur. The parietal muscles[1] are in the reproductive region strong with numerous folds and on transverse-sections of a rounded appearance (textfig. 92), in the capitular tract considerably weaker and arranged more or less in the shape of a fan (textfig. 90, 91). The part of the parietal muscles which expands on the column is considerable and as broad as the parietal muscle-pennon itself. The mesenterial filaments have a typical appearance. The animal is dioecious.

Fig. 88.

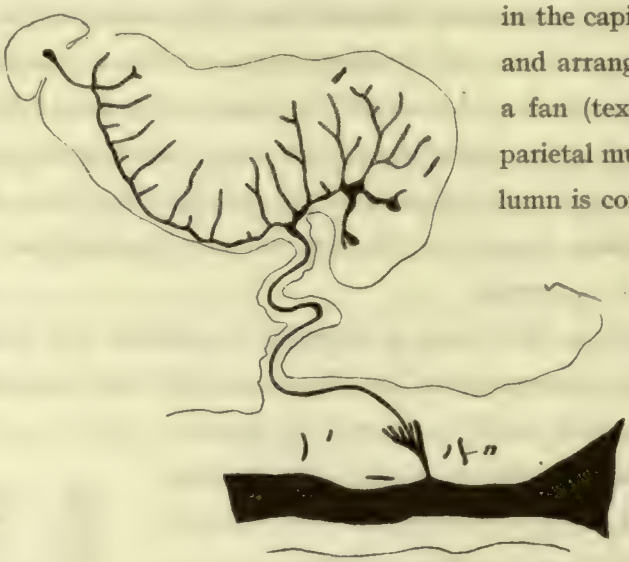


Fig. 89.

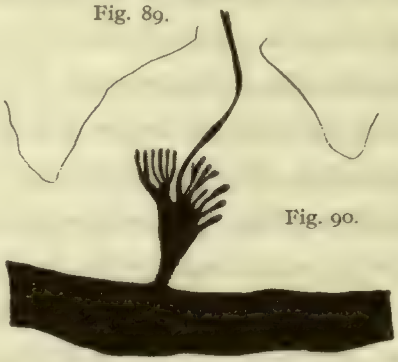


Fig. 90.

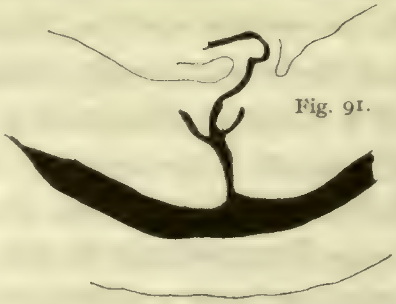


Fig. 91.

Fig. 92.

Textfig. 88—92. *Paraedwardsia sarsii.* Fig. 88: Transverse section of pennon in the reproductive tract. Fig. 89: Transverse section of a mesentery in the uppermost part of the cnido-glandular tract (in the capitular region). Fig. 90—92: Transverse section of parietal muscles in the capitular region (figs. 90, 91) and in the reproductive tract (fig. 92).

Biology: The animal lives unattached, mainly on sand (Appellöf) or on stones, or attached to shells? (*Lecythia* according to Sars).

Remarks: Whether Sars's *Lecythia brevicornis* is identical with Appellöf's *Edwardsia carnea* is very difficult to decide; on the other hand the species described by Appellöf is the same species as *Edwardsia Sarsii* Düb. & Koren, which I have been able to substantiate on specimens belonging to the Museum of Christiania and labelled "*Edwardsia sarsii* Düb. & Koren, Bergen, Manger, Sars". As to *Lecythia* it is possible that Sars's description alludes to the species later on described by Gosse as *Edwardsia carnea*; in reality Sars's figure and description of this species and its occurrence on *Saxicava* more recall *Edwardsia carnea* Gosse than *Paraedwardsia carnea* (Düb. & Koren). As it is, however, hardly possible to decide these

[1] Appellöf (1891, p. 21) states that the parieto-basilar muscles are absent in *E. carnea*. This is certainly not the case as the part of the parietal muscles on the opposite side of the pennons corresponds to the parieto-basilar muscle (compare Carlgren 1905, p. 517—518).

questions without examining Sars's type-specimen, if it exists, it may be more suitable totally to disregard the genus *Lecythia*, the more so as any diagnosis of the genus never was given by Sars. There, is, however, no doubt that *Lecythia* is identical with one or other of the genera *Milne-Edwardsia* and *Paraedwardsia*, proposed by myself. Of the latter genus I have had an opportunity of examining the specimens determined as *Edwardsia sarsii*, further the specimens in the Museum of Berlin (Schaudinn's sp.), those from Korshavn and Appellöf's specimens. Appellöf (1893) has given a description of the outer as well as the inner organisation of the species; on several points his description is completed here, especially as regards the nematocysts — Appellöf does not mention any nematocysts in the capitulum or in the ectoderm of the tentacles — and the occurrence of the "*Halcampa*-papillae" which are also overlooked by Appellöf; I made the section-series from the specimens from Bergen, Manger, from Appellöf's specimens, and from those from Korshavn. The text-figures, reproduced here, refer to the first-mentioned ones.

Fam. *Limnactiniidae* nov. fam.

Diagnosis: Athenaria without tentacles or sphincter. Perfect mesenteries 8—10 (or more?).

Concerning the position of the family and the reduction of the tentacles see my remarks to *Limnactinia leavis*.

Genus **Limnactinia** nov. gen.

Diagnosis: Limnactiniidae with the column not divisible into regions. Column smooth, without cuticle or "*Halcampa*-papillae." Proximal body-end rounded as a physa, perforated by apertures. Ectoderm af the oral disc very thickened, containing numerous spirocysts. Distal part of the column with spirocysts. No siphonoglyphes. Perfect mesenteries 8 to 10 with reproductive organs. Rather few imperfect mesenteries.

Of this genus I know two species, *Limnactinia laevis*, described below, and another one dredged by the Swedish Antarctic-Expedition at South Georgia.

Limnactinia laevis nov. sp.

Pl. 1. Figs. 13, 14.

. . . . nov. sp. Carlgren 1893, p. 23, Note.

Diagnosis: Proximal body-end with a central aperture surrounded by a cycle of 8 (-10?) apertures. Nematocysts in the proximal part of the column partly 14—18 μ long, partly 24 $\times$ 4 μ, in the distal part 11—14 μ in size. Spirocysts of the column 16—20 μ long. The most distal part of the column with a weak longitudinal muscle-layer. Ectoderm of the oral disc extraordinarily high with very numerous spirocysts, 19—36 μ long, and very sparse nematocysts, 11—14 μ long. Ectoderm of the actinopharynx with nematocysts 24—26 $\times$ 4 μ in size. 8 "*Edwardsia*-mesenteries" or 10 (8 + 2 dorsolateral) mesenteries perfect; the two ventrolateral mesenteries of the first cycle always imperfect. 2 (dorsal) to 4 (dorsal and lateral) mesenteries of the second cycle present. Longitudinal muscle-pennons of the perfect mesenteries in the reproductive region with 9—15 high folds, branched mainly in their outer parts. Outer lamellar part of the mesenteries attached close by the outer edge of the pennons. Parietal muscle with a few, thick folds. The expansion of the parietal muscles on the column is considerable. Several marginal stomata. Ciliated streaks discontinuous.

Colour: opaque white to yellowish-white with dirtily-yellow reproductive organs and filaments. In the distal part of a contracted specimen I observed brownish spots, discernible from the surface. Probably they belong to the uppermost part of the column or to the oral disc.

Dimensions: Two specimens from Gullmar fiord were 2,7 resp. 2 cm in length, and 0,2 in breadth. The length of the specimen from Kal fiord was 1,3 cm, its largest breadth 0,3 cm.

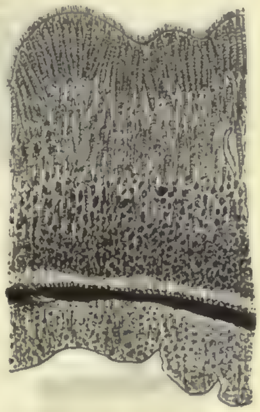
Occurrence: Sweden. Bohuslän. Gullmar fiord, Skår, Lindholm, between Lysekil and Kristineberg 30—70 fms. clay (Carlgren 1893) 5 sp.

Norway. Finmark. Kal fiord 80 m. clay (Goës and Malmgren 1861).

Exterior aspect: The body (Pl. 1, figs. 13, 14) is elongated and quite smooth, without a cuticle and provided with shallow, though distinct, longitudinal furrows corresponding to the insertions of the mesenteries. It is not divisible into regions. The proximal part is ampullaceous or pointed, according to the state of contraction. In the centre of this part there is an aperture surrounded by a cycle of apertures arranged as those of *Halcampa* (Carlgren 1893, textfig. 7). In one examined specimen the cycle contains 8 apertures, one in each "*Edwardsia*-compartment." It is possible that the number of apertures is 10, if 10 mesenteries are perfect. As far as I can see there are no tentacles. The animals having been dredged in deep water were not in full vigour in the aquaria. I have, therefore, only once observed a wholly expanded specimen. In this one I was not able to find any tentacles. Two other specimens were examined under strong magnifying power with the same results. I at first supposed that the tentacles were invaginated, as it is often the case in *Halcampoides*, or that they had been thrown off as in Bolocera, but soon discovered that there was nothing in the organization to support that supposition. The study of two serial sections, of which one is complete, likewise proved that there are no tentacles. The structure of the oral disc also indicates that the distal end of the animal is transformed. The oral disc is namely very much thickened and forms a high wall, provided with radial furrows, corresponding to the insertions of the mesenteries. The actinopharynx is short, in comparison with the length of the body. It is devoid of siphonoglyphes, gonidial tubercles and aboral prolongations.

Anatomical description: For anatomical examination I have sectioned series of two whole specimens. Of two others one has been transversely sectioned in the proximal part, the other one in the distal part. The specimen from Kal fiord I have sectioned longitudinally in the distal part, transversely in the tract of the actinopharynx and below the actinopharynx.

The wall of apertures in the proximal body-end is in structure similar to that of the *Halcampa* (Carlgren 1893 a). The three layers of the column are all of about the same thickness; in the distal part the ectoderm is, however, thicker than the other layers. In the ectoderm of the column the two common types of stinging capsules are found, in addition to large homogeneous, and smaller granulate gland-cells. The nematocysts are in the proximal part rather numerous and about 14—18 μ long, in the distal part a little more sparse and shorter (11—14 μ); the spirocysts, on the other hand, reaching to a length of about 16—20 μ are numerous in the distal part, in the proximal part very sparse, only here and there appearing. In the ectoderm of the column I have besides found somewhat larger nematocysts (24 $\times$ 4 μ), sometimes with a distinct basal part to the spiral thread. The uppermost part of the column is provided with distinct, though weak longitudinal muscles, forming a continuous layer in the tract where the spirocysts are common, but soon disappearing. A nerve-layer with nerve-cells is present and is the most developed in the uppermost part of the column. The mesogloea of the column is composed of alternate layers of longitudinal and circular fibrillae. The endodermal circular muscles form no special sphincter, but are rather well developed; in the proximal part, close by the proximal end, they are a little stronger than in the other parts. The muscle-folds are besides of different appearance, according to the state of contraction. The tract, corresponding to the region of the tentacles and the oral disc in other Actiniaria, is provided with a remarkably high ectoderm, several times higher than that of the column. The outer parts of this ectoderm consists, as a transverse-section through the oral disc shows (textfig. 93), almost exclusively of extraordinarily numerous, very closely packed spirocysts, 19—36 μ long; only exceptionally nematocysts appear, 11—14 μ long. The inner parts of the ectoderm are very deeply stained with the carmine of borax. Here we see the mother-cells of the spirocysts, and spirocysts in development. The nerve-layer is not very distinct, on account of the immense number of stinging capsules. The radial muscles of the oral disc are weak and its mesogloea thin. The ectoderm of the actinopharynx is several times thicker than the mesogloea, here and there sending out irregularly placed tongues towards the lumen of the actinopharynx.


Textfig. 93. *Limnactinia laevis*. Transverse section of oval disc.

The nematocysts of the actinopharynx ectoderm are broader in the basal end than in the distal one, and the basal part to the spiral thread is perceptible; their size is about $24—26 \times 4\ \mu$. Also in the actinopharynx there are longitudinal muscles, though weak, but distinct, especially in the aboral part. The actinopharynx is provided with several longitudinal ridges and furrows. I have not observed any siphonoglyphe.

The mesenteries are partly perfect with longitudinal pennons, reproductive organs and filaments, partly imperfect without such organs. The number of perfect mesenteries variates from 8 to 10. In three examined specimens only the 8 "*Edwardsia*-mesenteries" were perfect (textfig. 94—95); in two larger specimens, provided with well developed reproductive organs, also the fifth couple was perfect (textfig. 96); thus the number and the arrangement of the mesenteries were in conformity with those of *Pentactinia* (Carlgren 1900). Four (2 dorsolateral and 2 ventrolateral) or two (ventrolateral) imperfect mesenteries together with the 8 resp. 10 perfect "*Edwardsia*-mesenteries" form the first cycle of six pairs of mesenteries. An imperfect second cycle of weak mesenteries, not projecting over the surface of the endoderm, is present. In one specimen only two pairs of mesenteries, one in each dorsolateral exocoel, were developed; in the other specimens there were 4 pairs in the dorsolateral and the lateral exocoels. In the ventrolateral exocoels I have never found any mesenteries. The arrangement of the muscles is the same as in other elongated Athenaria. The longitudinal pennons are strong, the high folds, however, rather few, in the upper part of the reproductive region about 9—15; they are mainly branched in their outer parts. The parietal muscles as well as the muscles of the imperfect mesenteries are provided with short and coarse folds. The expansion of the parietal muscles on the column is considerable and often extends far sideways from the folds of the parietal muscles. Below the pennons the parietal muscles are as usual more elongated, form no folds and are attached

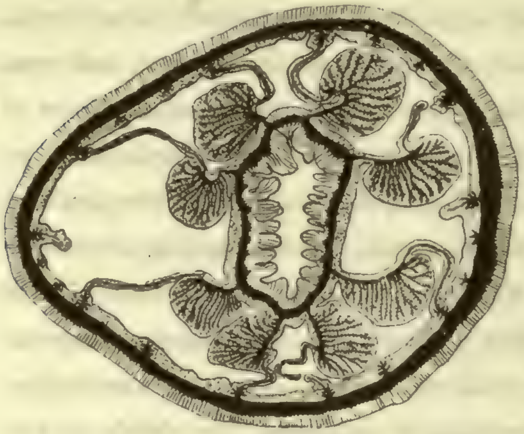


Fig. 94.

Fig. 97.

Fig. 95.

Fig. 98.

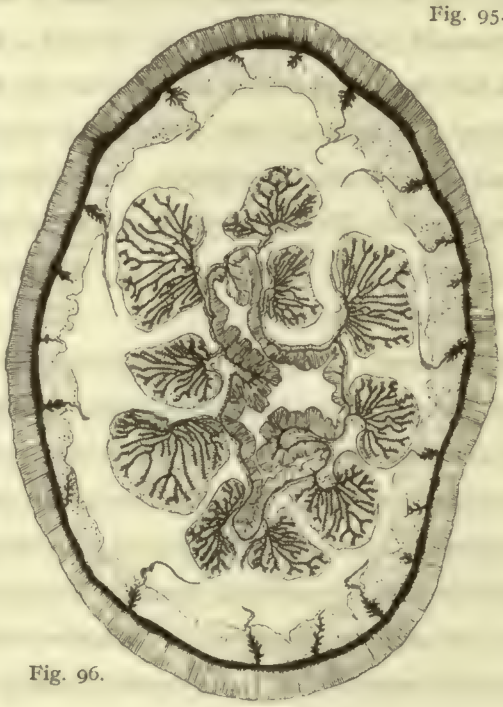


Fig. 96.

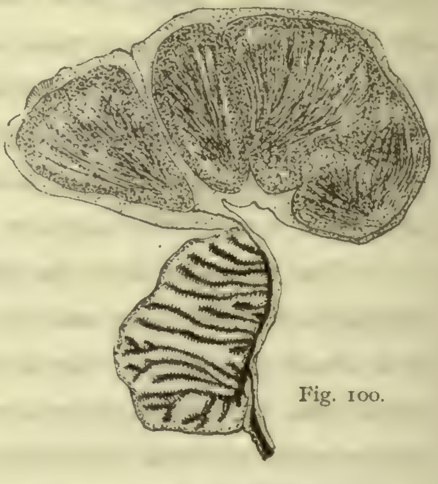


Fig. 100.

Fig. 99.

Fig. 101.

Textfigs. 94—101. *Limnactinia laevis.*
Fig. 94. Transverse section of a specimen with 8 perfect mesenteries in the upper part of the actinopharynx. — Fig. 95. A similar section of the same specimen in the lower part of the actinopharynx. — Fig. 96. Transverse section of a specimen with 10 perfect mesenteries. — Figs. 97—101. Transverse sections of a mesentery in the reproductive tract. If we indicate the first section (fig. 97) with 1, the following sections are the fourth, the eighth, the sixteenth and the twenty-third.

to the mesogloea as an even lamella. The fifth couple viz. the ventral mesenteries of the dorsolateral pairs, project as imperfect mesenteries a little over the surface of the endoderm; in this state they carry very undeveloped filaments, but no reproductive organs, figs. 94, 95. The mesenteries of the sixth couple, viz. the ventral mesenteries of the ventrolateral pairs, are always very weak and only a little stronger than the mesenteries of the second cycle.

The ten stronger mesenteries are provided with stomata. As in *Scytophorus antarcticus* there are several stomata distally placed in each perfect mesentery, they do, however, seem to be less numerous (unto

4 in each mesentery). Commonly they are found in the middle or in the outer rim of the mesenteries. In the section reproduced in the textfigure 96 the stomata have been hit, and the mesenteries thus discontinued. The filaments appear only on the 8 to 10 perfect mesenteries. The ciliated streaks are very long, but discontinuous as in *Scytophorus antarcticus* and *Isoedwardsia mediterranea*, and thus divisible into several portions along the middle streak. The textfigure 97 shows a transverse-section through a mesentery with a testes follicle and a rather well developed middle streak; a little farther down, towards the proximal end, we find rather well developed ciliated streaks (textfig. 98) which are still more distinctly seen on the following transverse-section (textfig. 99). In a transverse-section still farther down (textfig. 100) we meet several testes follicles, but only a rather inconsiderable middle streak. In the following sections we again find the middle streak (textfig. 101). The filaments are, as for the rest, of usual structure, and the cnido-glandular tract thicker than the middle streak. Three examined specimens were males, a fourth one a female. The reproductive organs were well developed, especially in the specimens with 10 perfect mesenteries.

Biology: The animal lives on clay bottom, and on account of its particular structure it might very well have the habits of a worm. Probably it pushes deep down into the clay, for it is worth noticing that I have observed the animal only one summer when we used a deep-going dredge, constructed by Professor Tullberg, at the zoological station of Kristineberg, and never during the many others summers I spent at the station. With its proximal end it is able to penetrate into the clay as the Edwardsids and Halcampids; but also the distal end possibly serves as a boring organ. As the tentacles are wanting, the animal must take its food in another way than the other Actiniaria, it is therefore possible that it feeds upon detritus-particles in the clay, though I have not found any such in its coelenteric cavity. It is besides reasonable to suppose that the strongly thickened oral disc with its numerous spirocysts ("Klebkapseln") has undertaken the function of the tentacles as capturing apparatus.

The occurrence of a really tentacle-lacking Actiniaria is thus established. True enough, R. Hertwig (1882, 1888) has believed himself to have discovered forms, among the Actiniaria from the Challenger Expedition, which were tentacle-lacking or with very reduced tentacles, but these observations have appeared not to be correct. The tentacle-lacking Actiniaria, described by R. Hertwig, are namely to be referred to forms having thrown off their tentacles (Mc. Murrich 1893, Carlgren 1899), and those with strongly reduced tentacles, provided with large stomidia, to forms, the state of preservation of which leaves a great deal to be desired. (Compare *Sicyonis crassa*). In the cases where the bad preservation of the animals has made it impossible to perform a control-examination we may resort to a similar kind of explanation. In some cases recorded by Hertwig — as far as I remember especially of *Polyopis* — it is possible that the tentacles were invaginated before they were macerated. In the genus *Halcampoides* it namely often happens that some tentacles, rarely all, become invaginated on preservation. In the latter case, when all tentacles are invaginated, it looks as if they are wanting, and only large stomidia remaining. Very small tentacles we find in some Discosomids, especially in *Discosoma Unguja*. Here the tentacles, arranged in radial rows, do not reach the surface of the oral disc, but are indicated by invaginations in the mesogloea of the oral disc.

Systematic remarks. I have placed this family among the Athenaria because of the structure of its proximal end and of that of its mesenteries. The presence of ectodermal muscles and of spirocysts in the uppermost part of the column would possibly make this species entitled to a position among the Protactininae, but as a similar distribution of the ectodermal muscles and the spirocysts also occurs in the genus *Halcampa*, though these organs do not reach as far down in the latter species as in *Limnactinia laevis*, I think that we may, at least provisionally, place it with the Athenaria. It is, besides, possible that the presence of the ectodermal muscles in the column is a secondary feature arisen in connection with the manner of living of the animal. In the second species of the genus I have not found any ectodermal muscles in the column, but only spirocysts.

Fam. *Halcampoididae.*

Diagnosis: Athenaria (Abasilaria) generally with elongated body and with proximal body-end physa-shaped or flattened. No sphincter or a very weak endodermal one. Tentacles always present, commonly with more than 8 perfect mesenteries (in *Synhalcampella*[1] only the "*Edwardsia*-mesenteries" perfect). No acontia. Ciliated streaks present, rarely discontinuous.

To this family which is identical with the Halcampomorphidae, proposed by myself, I refer, as above mentioned (p. 21), *Halcampoides* Dan., *Acthelmis* Lütk., *Phytocoetes* Ann. and *Halcampella* Andr., the last genus under the supposition that the type, as yet not examined in detail, *H. endromitata* Andr., has no mesogloeal sphincter[1]; further *Scytophorus* R. Hertw., *Pentactinia* Carlgr., *Harenactis* Torrey, *Siphonactinopsis* Carlgr., *Mesacmaea* Andres (the last genus under the same supposition as *Halcampella*). *Peachia* Gosse, *Eloactis* Andres, *Haloclava* Verrill, and finally also *Polyopis* R. Hertw. may be placed to this family (compare below). I have above (p. 19-20) more amply discussed the correctness of placing *Peachia, Eloactis* and *Haloclava* in one particular family. On account of the arrangement of the tentacles — the shorter are off-shoots of the endocoels — we might possibly establish a sub-family Peachiinae for these genera, and bring together the others in a sub-family Halcampoidinae with the endocoel-tentacles of the first order longer or as long as the other tentacles. The column is smooth in *Halcampoides, Acthelmis, Phytocoetes, Harenactis, Siphonactinopsis, Mesacmaea* and *Peachia;* in *Halcampella, Scytophorus* and *Pentactinia* furnished with "*Halcampa*-papillae"; in *Eloactis* with low, rounded papilliform thickenings, mainly composed by the ectoderm, and in *Haloclava* with longitudinal lines of ampullaceous papillae in the distal part of the body-wall. The papilliform thickenings of *Eloactis*

[1] Probably *Halcampella endromitata* has no sphincter. To judge from the arrangement of the mesenteries, this species seems to agree with *Halcampella maxima* and with a new species, *H. robusta*, not as yet described by me. They have no sphincter, and the very weakly developed, imperfect mesenteries only occur in the most distal part of the body. A schematic figure, placed at my disposal by Dr. Andres, namely shows that in *H. endromitata* only 12 mesenteries are developed below the actinopharynx. In contradistinction to this, the imperfect mesenteries are developed along the whole body in the genus *Cactosoma*, which within the family Halcampidae corresponds to *Halcampella* within the Halcampoididae. Concerning the *Halcampella Oustromovi*, described by Wyragéwitch (1905), its systematic position is dubious. Its very little size (the animal was 2—3 mm long), its inconsiderably developed reproductive organs and its other structural features, indicate that the species has not yet gained its definitive size. W. declares that it has no sphincter; it is, however, possible that it was overlooked by him, because of the littleness of the animal. Below the actinopharynx there are unto 32 mesenteries developed, which seem to indicate that we possibly have to do with a *Cactosoma.*

If we do, however, so far see good to accept the statement of W., concerning the sphincter, it is necessary to propose a new genus for *H. Oustromovi*. The new genus, *Synhalcampella,* may be characterized as follows:

Halcampoididae with the column divisible into three regions, physa, scapus and capitulum. Physa without apertures. Scapus probably with "*Halcampa*-papillae." No sphincter. Tentacles more than 12, rather short, dactyliform. Siphonoglyphes probably indistinct, without a conchula. 2 pairs of directives. Only the "*Edwardsia*-mesenteries" perfect, with pennons (only the 2 lateral couples of mesenteries fertile and with filaments). The 5th and the 6th couples and the mesenteries of the younger cycles weak, without pennons along the whole or almost the whole length of the column.

and the papillae of *Haloclava* are to be regarded as slight stinging batteries (compare these genera!). A ventral siphonoglyphe only occurs in *Peachia*, *Haloclava*, *Eloactis*, *Pentactinia*, *Harenactis*, *Siphonactinopsis*, *Mesacmaea* and *Scytophorus*; in the last genus it is rather slightly differentiated. The other genera have either no siphonoglyphes or 2 not very distinct ones. A biradiate, hexamerous arrangement of the mesenteries we find in *Halcampoides*, *Acthelmis*, *Halcampella* and *Harenactis*, though also here traces of the bilateral development often appear, in as much as the 5th and 6th couples of the mesenteries of the first cycle are weaker than the others of the same cycle. *Scytophorus* is furnished with 7 pairs of mesenteries with apparently one pair of directive mesenteries, the ventral one. In *Mesacmaea* which has not been anatomically examined in details, 7 pairs of stronger mesenteries seem to be found, according to Andres's notes which have been placed at my disposal. The ventral directive mesenteries belong to the stronger mesenteries, while the dorsal directives are weaker and in size like the mesenteries of the second order. In another work I will give a more minute account of Andres's notes. *Pentactinia* has 10 pairs of mesenteries; the ventrolateral pairs of the second cycle are not developed. *Peachia*, *Eloactis* and *Haloclava* also have 10 pairs, but here the dorsolateral mesenteries of the second cycle are absent. Finally *Siphonactinopsis* is furnished with 20 pairs of mesenteries. Reproductive organs are developed on all mesenteries in *Halcampoides*, *Scytophorus*, *Siphonactinopsis*, *Mesacmaea* (according to Andres's notes), *Eloactis* and *Haloclava*. Ciliated streaks are present on all examined species. As to *Harenactis* Torrey (1902) has not given any minute informations concerning its filaments. In *Scytophorus* the ciliated streaks are discontinuous and found in several different portions along the middle streak. According to Torrey cinclides[1] occur in *Harenactis* and according to Annandale (1915) in *Phytocoetes*. I have also found cinclides in *Eloactis*. Spirocysts seem to be absent in the tentacles and oral disc of *Eloactis* and *Haloclava*.

To this family also the genus *Polyopis*, proposed by R. Hertwig (1882), may probably belong. Unfortunately a controlling of Hertwig's investigations of the already at the date of his investigation very deformed specimen is no more possible, as there is not much left of the specimen now, and what remains has probably once been exsiccated. Therefore I must restrict myself to some general reflections on Hertwig's description. Concerning the reduction of the tentacles his statement may be admitted with the greatest reservation. It is possible that the animal has thrown off its tentacles, another eventuality is that the tentacles have been torn off or contracted so strongly that they project only as low walls. It was namely proved by a control examination of *Liponema* (Mc. Murrich 1893, Carlgren 1899) — a genus devoid of tentacles, according to Hertwig — that the tentacles had been thrown off. R. Hertwig's statement that *Sicyonis* has very short papilliform tentacles with large stomidia, is also incorrect. True enough, the tentacles of *Sicyonis* are short, but they are not so reduced as Hertwig thinks, and the large stomidia are nothing but artificial products due to the bad preservation of the tentacles, as I will afterwards prove. Finally we might presume that the tentacles of *Polyopis* had been invaginated in the coelenteric cavity before the maceration (comp. p. 79). I, for my part, do not think that the tentacles of *Polyopis* have been reduced, at any rate not in such a way as described by Hertwig. Be this as it may, the rounded proximal body-end and the absence

[1] Stephenson (1920, p. 447) also names the apertures in the physa or proximal end cinclides. Though the walls, surrounding the cinclides and the apertures in the physa or proximal end, are of about the same structure, I think that it is most practical to retain the name of cinclides in its original extent.

of a sphincter indicate that the genus may be placed to the family Halcampoididae. The openings in the actinopharynx also seem peculiar to me and may require a control examination. Hertwig declares that the number of mesenteries is 36; if we narrowly examine his figure 11 B, Pl. 11, which represents the aboral body-end seen from the gastral side, we find some ridges corresponding to the basal part of the mesenteries. Judging by the ridges I cannot but find that the animal has 20 pairs of mesenteries, 8 stronger and 3 weaker pairs in 4 compartments. I do not see a single reason for the necessity of establishing a distinct family for this so imperfectly known genus. If we are to keep the family Polyopiidae, there is no doubt that its place is with the group Athenaria. Possibly *Polyopis* is related to *Siphonactinopsis*, as both are provided with 20 pairs of perfect mesenteries.

Genus **Halcampoides** Dan.

Diagnosis: Halcampoididae with elongated body. Column not distinctly divisible into regions, with 2 cycles of apertures in the rounded, physa-shaped proximal body-end, smooth, without "*Halcampa*-papillae" or spirocysts in the ectoderm, without a cuticle. No sphincter. Tentacles 12, rather long, cylindrical, not bulbously swollen in the apex. Siphonoglyphes 2 somewhat indistinct, without a conchula, 2 pairs of directive mesenteries. Only 6 pairs of mesenteries, all perfect and fertile. Ciliated streaks of typical appearance.

Stephenson (1918 a, p. 10) has placed *Halcampoides* and *Halcampella*, viz. Hertwig's species *Halcampella maxima* in a genus *Halcampoides*. This arrangement does not seem very suitable to me, as *Halcampoides* with its smooth column and its indistinct region-division is essentially differentiated from *Halcampella*, which shows a distinct division in regions of the column and is furnished with "*Halcampa*-papillae." If *Halcampoides* should be connected with another genus, it would be with *Acthelmis* to which it is indubitably very nearly allied. Stephenson's species, *Halcampoides aspera* also ought to be named *Halcampella aspera*, under the supposition that the type *H. endromitata* has an endodermal sphincter. If the spincter is mesogloeal in the type-species, Hertwig's *Halcampella* to which also *Halcampoides aspera* belongs, should have a new name, for which, in that case, I would propose *Epihalcampa* (compare p. 80).

Halcampoides purpurea (Stud.) Carlgr.

Pl. 1, figs. 34, 35. Pl. 2, figs. 11, 12.

Halcampoides purpurea n. sp. Studer 1878, p. 545. Pl. 5, figs. 20 a, b.

— — Stud. Andres 1883, p. 315. Haddon 1889, p. 336. Kwietniewski 1896, p. 586, Pl. 25, figs. 1—4. Appellöf 1896, p. 13.

Halcampoides abyssorum n. sp. Danielssen 1890, p. 93, Pl. 5, fig. 1, Pl. 15, figs. 4—11, Pl. 16, figs. 1—3. Mc. Murrich 1913, p. 969.

Aegir frigidus n. sp. Danielssen 1887, Pl. 2, figs. 1, 5, 6, 11. 1890, p. 151, Pl. 5, fig. 4, Pl. 18, figs. 5—10, Pl. 19, figs. 1—4.

Fenja mirabilis n. sp. Danielssen 1887, Pl. 1, Pl. 2, figs. 2—4, 1890, p. 144, Pl. 17, figs. 1—14, Pl. 18, figs. 1—4.

Halcampa clavus Quoy a. Gaimard. R. Hertwig 1882, p. 82, Pl. 3, figs. 1, 4, 10, Pl. 12, figs. 8, 9, 11. Pl. 13, figs. 2, 4, 7. Tizard and Murray 1881, p. 674. Haddon 1889, p. 336. Pax 1910, p. 304, 1914, p. 585—586.

Halcampoides clavus (Quoy a. Gaimard? Hertwig) Appellöf 1896, p. 13, Pl. 1, 2.

Halcampomorphe clavus (R. Hertwig) Carlgren 1893, p. 38 (1900, p. 1170).

Halcampoides elongatus n. sp. Carlgren in Stephens. 1912, p. 58 (8).

Halcampa septentrionalis n. sp. Pax 1912, p. 312, 1914, p. 586.

Halcampa kerguelensis n. sp. R. Hertwig 1888, p. 28, Pl. 2, fig. 5. Appellöf 1896, p. 14.

Diagnosis: Nematocysts in the ectoderm of the column partly larger, 19—36 × 3—4 μ, partly smaller, (10) 12—24 × 1,5 μ; in that of the tentacles 22—38 × 2—3 μ; in that of the actinopharynx partly smaller, 12—14 × 1,5 μ, partly larger 27—46 × 3—4 (5) μ. Nematocysts with discernible basal part to the spiral thread 20—24 × 4—6 μ. (concerning the nematocysts of forma *mediterranea* compare below). Spirocysts in the ectoderm of the tentacles of variable size from 14 × 1,5 μ to 40 × 4—5 μ, some capsules sometimes larger. Column with 12 longitudinal furrows corresponding to the insertions of the mesenteries. Longitudinal muscle-pennons in the upper part of the reproductive region with very numerous, high, often (especially in large specimens) rather richly ramificated folds. Outer lamellar part of the mesenteries attached close to the outer edge of the pennons. Parietal muscles strong, well limited, with in the outer parts low, in the inner ones high folds which in large specimens are from somewhat to very richly ramificated. Marginal stomata present.

Colour: Purple-coloured, tentacles brownish (*purpurea* teste Studer). — Column pale rose-red. Oral disc and tentacles intense crimson, the disc a little paler than the tentacles (*Aegir* teste Danielssen). — Column flesh-coloured with lighter longitudinal stripes, anterior part pellucid, oral disc pellucid with rose-coloured rays shading off into violet. Tentacles light red, at their base with a brownish-violet patch extending stripe-like along the adoral side right up to the point (*Fenja* teste Danielssen). — Column rose-red, posterior extremity with a faint violet play of colour, oral disc rose-red. Tentacles dark red, shimmering faintly crimson (*Halcampoides* teste Danielssen). — Column yellowish-white with a play of rose-colour, distal part greyish to whitish-yellow. Tentacles brown, more or less shading off into green. — Column yellowish-white with a play of reddish-violet, here and there with darker stripes. Distal part and the tentacles as the preceding specimens (two specimens from Greenland teste Arwidsson). — Proximal part of the column reddish-yellow, distal part bluish-violet. Tentacles flesh-coloured (a preserved specimen from the Ingolf-Expedit.) — Column flesh-coloured shading off a little into brown (a spec. from Bohuslän). — Column ochreous-coloured, the distal part more pale (a preserved specimen from Ireland, *elongatus*).

Dimensions: in expanded state to 4,5 cm (teste Studer). — Length of the body 7 cm, largest breadth 2,4 cm (a very large preserved spec. from the German Tiefsee-Expedition). — Length of the body 1,5—2 cm, breadth 0,5—1 cm (*clavus* in preserved state teste Hertwig). — Length of the body 1,5—2,5 cm, largest breadth 0,7—1 cm (*kerguelensis* in preserved state, teste Hertwig). — Length of the body 10 cm., largest breadth 1,5 cm. Length of the tentacles 1 cm (a preserved spec. from Naples). — Length of the body 7 cm, breadth 1,5 resp. 1,2 cm (*Fenja* and *Halcampoides* in expanded state, teste Danielssen). —

Length 5,5 cm, largest breadth 0,9 cm (a spec. from the Ingolf-Exp. in preserved state). — Length 3,6 cm, largest breadth 2,5 cm (a spec. from Scoresby Sound). — Length 3 cm, breadth in the distal part 0,7 cm. (*elongatus* from Ireland).

Occurrence: West-Greenland. Davis Strait 65°11′ N 53°35′ W 48 fms. green clay (Ingegerd and Gladan-Exp. 1871), Nordre Strømfiord (Nordmann St. 2) Godthaab 100 fms. Ammondsen.

East-Greenland. Scoresby Sound, Hurry Inlet (Greenland-Exp. 1900 Søren Jensen), Cape Dalton 9—11 fms. (Greenland-Exp. 1900, Søren Jensen), Fame Isl. 5—8 m, mud, 70°50′ N. 22°33′ W. $^1/_8$ 23—28 m (Sw. Greenland-Exp. 1899), Cape Stewart 13—18 m, mud, stones, algae (Sw. Greenland-Exp. 1899), Franz Joseph fiord. Outer part of the Myskoxe fiord 220 m (Sw. Polar-Exp.), Mackenzie bay, N. of Franz Joseph fiord 1—35, m, mud and sand (Sw. Polar-Exp. 1900), Greenland without locality.

NE. of Iceland. 65°33′ N. 10°28′ W. 492 fms. Temperature at the bottom ÷ 0,3° (Ingolf-Exp. St. 107).

Faroe Channel. 60°29′ N. 8°19′ W. 374 fms. Temp. at the bottom ÷ 0,5° (Knight Errant-Exp. 1880 *septentrionalis*) 61°08′ N. 9°28′ W. 820 m (Thor-Exp. 1904 St. 78).

W. of Northern Norway 66°41 N. 6°59′ E. 640 m, coarse-grained clay. Temp. at the bottom ÷ 0,9° (Norw. North Atl.-Exp. 1877, St. 124), 68°21′ N. 10°40′ E. 836 m. Sand and clay. Temp. at the bottom ÷ 0,7° (Norw. North Atl.-Exp. 1877, St. 164). (Norw. North Atl. Exp. 1877, St. 173—174), 71°25′ N. 15°41′ E. 1134 m, clay. Temp. at the bottom ÷ 1° (Norw. North Atl.-Exp. 1877, St. 200).

Behring Sound. 2 miles N. of the winter-haven of Vega. 12 fms., stones and sand (Vega-Exp. 1878) NW. of Behring Sound 66°58′ N. 171°35′ W. 21 fms. (Vega-Exp.).

Sweden. Bohuslän. Outer part of the Gullmar fiord. Bonden (Carlgren 1895, 1 sp. *elongatus*).

Further distribution: Ireland. 21 miles E. $^1/_4$ N. of Clare Island light house 21 fms. (Helga-Exp. 1 sp. *elongatus*).

The Mediterranean. Naples (Lo Bianco, 1 sp. probably from deep water). Antarctis. Kerguelen 6—100 fms. mud (Gazelle-Exp. *purpurea*), Betsy Cove 49°16′ S. 70°12′ E. 25 fms. Christmas Harbour 120 fms. (Challenger-Exp. *clavus*) London river 110 fms., Cumberland bay 105, 127 fms. (Challenger-

Exp. *kerguelensis*) 48°57'8 S. 70°06' E., 88 m (German Tiefsee-Exp. 1898). South Georgien 54°22' S. 36°28' W. Kocktopf bay 22 m, clay and algae (Sw. South Polar-Exp. 1902, N. 33), 54°11' S. 36°18' W. Cumberland bay 252—310 m, gray clay with stones. Temperature at the bottom 1,45° (Sw. South Polar-Exp. 1902 N. 34), Graham region about 64°3' S. 56°37' W. 360 m? Clay. (Sw. South Polar-Exp. 1902, St. 6).

Exterior aspect: The body is either cylindrical or oval, according to the state of contraction. Very expanded specimens reach a considerable length, and also in very contracted specimens the length is much larger than the breadth. The column, secerning a mucus-membrane, shows no distinct division in regions. The proximal part is rounded, physa-shaped and perforated by apertures which are, at least in larger specimens, 24 in number and arranged in two cycles. No central pore is present, which was also stated by Appellöf (1896) of the specimens collected by Danielssen. Studer declares that *purpurea* is furnished with only one aboral pore, an opinion which is adopted by Kwietniewski. This is, however, not the case, as I have been able to prove on the type-specimen. The aboral "pore" is nothing but a lowering, caused by the contraction of the proximal body-end. When the ectoderm is pencilled away here, it is distinctly seen that no central pore is present in the middle of the proximal end, — the presence of such a pore is besides impossible, because of the coalescence of the mesenteries in the centre. On the other hand, I have, in several compartments, found 2 radially placed pores. It admits of no doubt that *purpurea* resembles *abyssorum* and *clavus*, as regards the arrangement of the pores. The column is furnished with mostly distinct longitudinal furrows corresponding to the insertions of the mesenteries, and lacks each trace of papillae; its ectoderm forms no cuticle. The tentacles of the adult specimens, which are short in proportion to the length of the body, are 12 in number, cylindrical, sometimes pointed, according to the state of contraction, and all of the same size. In a small specimen from Cumberland bay, 0,7 mm long and 0,2 mm broad, without reproductive organs, the number of tentacles was only 8. The tentacles all may be invaginated, so that the ectoderm is turned inwards, thus we may find now one or two, now almost all or all the tentacles invaginated. In the latter case the animal seems to be without tentacles, and on the margin of the oral disc only crateriform openings, surrounded by walls, are to be observed. The tentacles sometimes show shallow longitudinal furrows, sometimes a deeper furrow appears on the middle of the tentacles — also observed by Appellöf. In *H. clavus* Hertwig has seen a longitudinal furrow both on the inside and the outside. Any greater importance in systematic respect I cannot ascribe to these furrows, as they are most probably due to an irregular contraction of the tentacles. The oral disc is broad and radially sulcated. The siphonoglyphes are not distinctly differentiated from the outer part of the actinopharynx and lack gonidial-tubercles and aboral prolongations. The actinopharynx is short, of about the length of the tentacles and provided with 12 high longitudinal ridges, extending directly into the middle streak of the filaments. On the actinopharynx of the preserved specimens numerous transversal folds are also to be observed.

Anatomical description: The ectoderm of the column is high with numerous gland-cells. The nematocysts are of two different kinds here, in the actinopharynx of three kinds, one of which has a discernible basal part to the spiral thread; in the tentacles there is only one kind of nematocysts. The size of

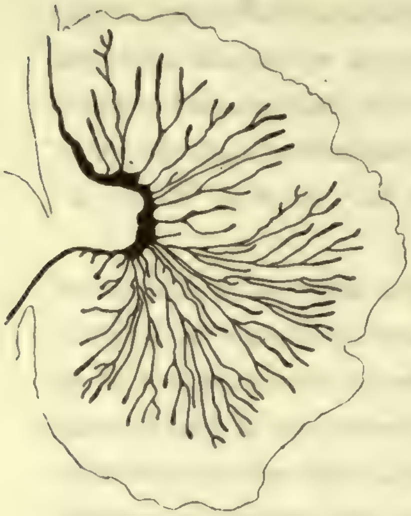


Fig. 102.

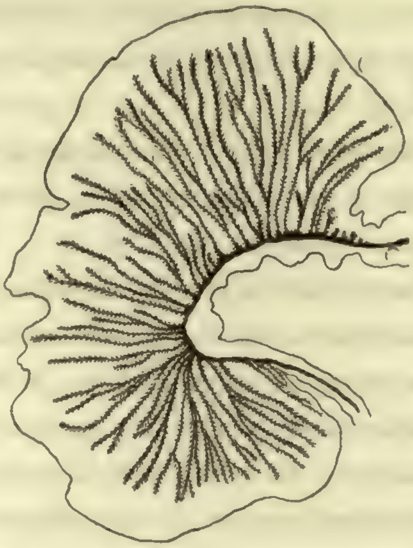


Fig. 103.

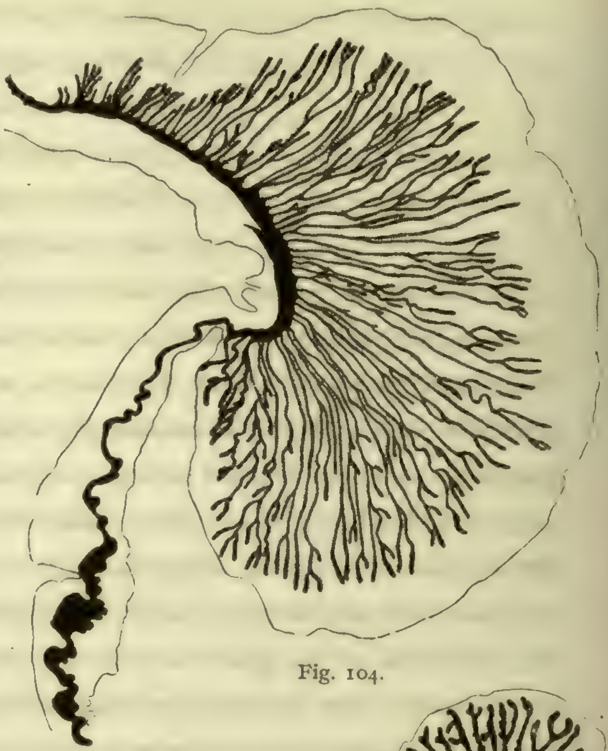


Fig. 104.

Fig. 105.

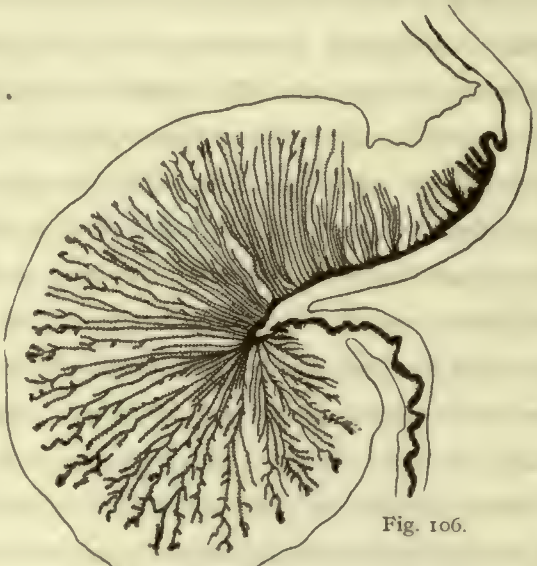


Fig. 106.

Fig. 107.

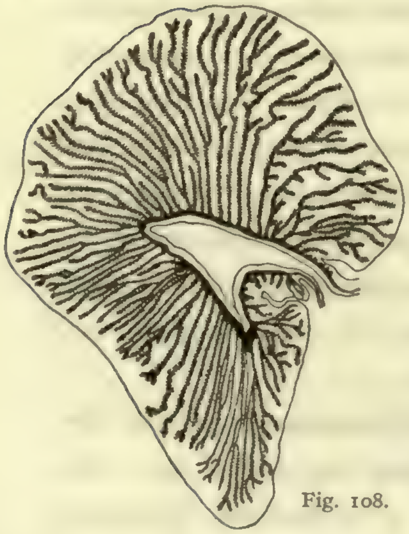


Fig. 108.

Textfigs. 102—108.

Halcampoides abyssorum.

Transverse sections of pennons. Figs. 102—103 from small, not sexually ripe specimens (fig. 102 spec. from Bohuslän, fig. 103 spec. from Ireland), fig. 104 from a large specimen from Scoresby Sound, fig. 105 from the large specimen from Naples. Fig. 106 from the very large spec. from the German Tiefsee Exp., figs. 107—108 from two specimens of *H.* "*kerguelensis*". The five last sections have been taken in the upper part of the reproductive region.

the spirocysts and the nematocysts of several specimens I have given below in μ, a. typical nematocysts, aa. nematocysts with discernible basal part to the spiral thread, b. spirocysts.

	Column		tentacles		actinopharynx		
	a	*a*	*a*	*b*	*a*	*a*	*aa*
1)	29—31 × 4 μ	17—20 × 1,5 μ	30—38 × 3 μ	—38 × 4 μ	39—46 × 4(5) μ	19—22 × 1,5	27—34 × 5 μ
2)	27—36 × 3—4	14—19 × 1,5	29—35 × 2,5	14 × 1,5—34 × 4	—	—	—
3)	29—36 × 3—4	17—24 × 1,5	26—31 × 2—2,5	—36 × 4-5	31—37 × 3—4	17—22 × 1,5	29—31 × 5—6
4)	19—26(36) × 3—4	13—17 × 1—1,5	26—29 × 2,5	—37 × 4-5	27—30 × 2,5—3	12—14 × 1,5	20—24 × 5
5)	26—31 × 3—4	14—17 × 1,5	—	—	—	—	—
6)	24—30 × 3—4	14—17 × 1,5	24—31 × 2—2,5	—26 × 4	31—37 × 3	17—22 × 1,5	22—26 × 5
7)	24—29 × 3	14—17 × 1,5—2	24—31 × 2,5	19 × 1,5—36 × 4	34—41 × 4,5	19—23 × 1,5	29—31 × 5
8)	22—25 × 2,5—3	12—19 × 1,5—2	26—34 × 2,5	19 × 1,5—36 × 4,5	31—41 × 4	12—17 × 1,5	31 × 5
9)	21—26 × 3	(10) 12 × 1—1,5	22—25 × 2	17 × 1-1,5—38 × 5	31—38 × 4	22 × 1,5	29 × 5
10)	28—32	—	28—32	—36	36	—	—
11)	—	14—16	24	—	—	22—24	26—31 × 6
12)	—	19—22 × 1—2	19—23 × 1,5—2	19 × 1,5—37 × 4	26—34 × 3—4	22—24 × 2	34—38 × 6—7

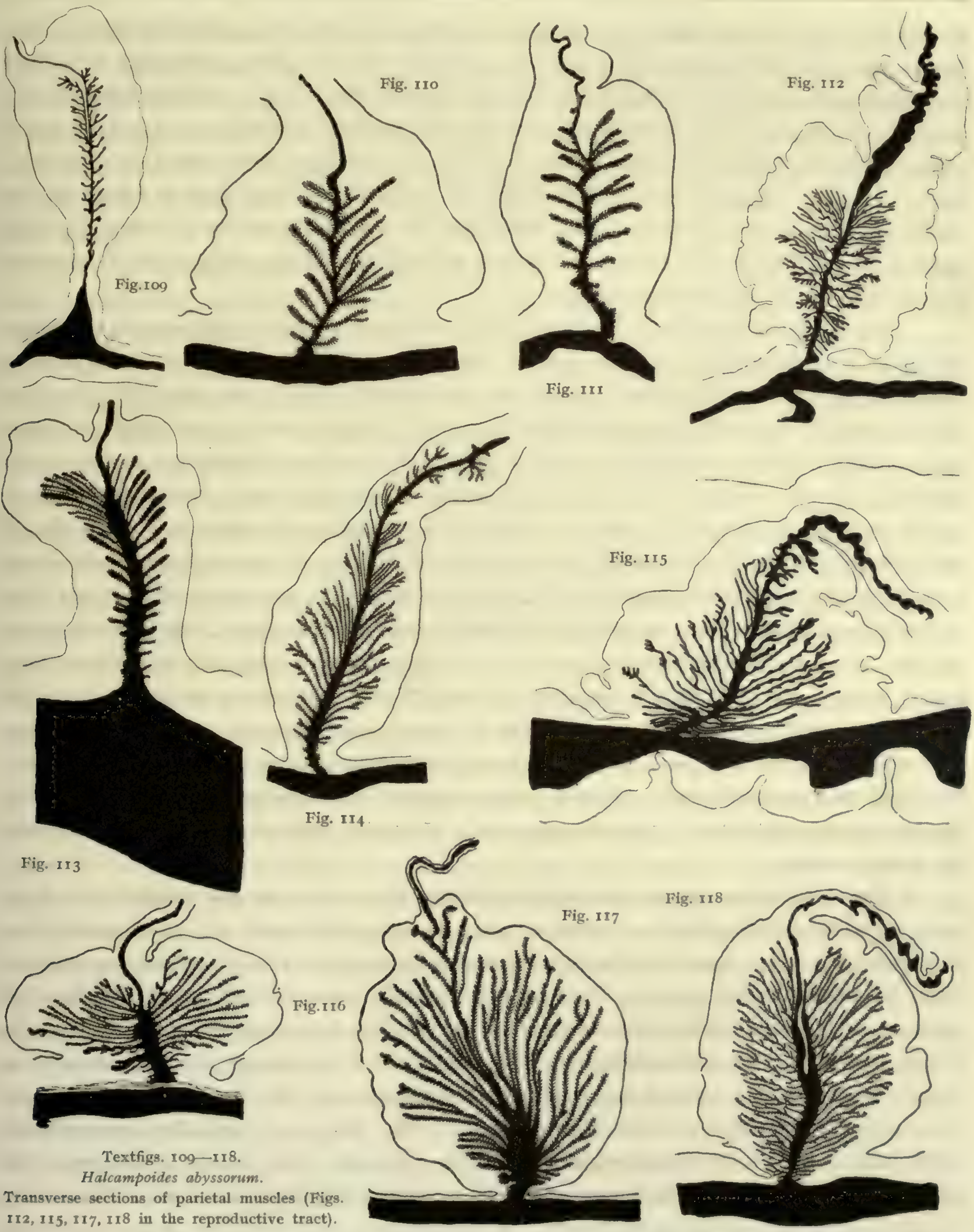
1) sp. from Scoresby Sound, size see above! 2) sp. from Hurry Inlet, length about 4 cm, breadth 3 cm. 3) sp. from NW. of Behring Sound, length 3,8 cm, breadth 1,2 cm. 4) sp. from the Ingolf-Exp. size see above! 5) a small specimen from Hurry Inlet, breadth 0,3 cm. 6) sp. from Scoresby Sound, length 1,8 cm, breadth 1 cm. 7) sp. from the German Tiefsee-Exp., size see above! 8) sp. from the Graham region, length 4,5 cm, largest breadth 1,3 cm, length of the tentacles 1,4 cm. 9) *kerguelensis.* 10) *clavus.* 11) *elongatus*, size see above! 12) sp. from Naples. The dimensions of the nematocysts of the specimen 9 are only approximate, as they refer to old measurements from 1897.

If we disregard the specimens 11 and 12, in the column of which I have not found any large nematocysts, the other specimens do very well agree. The nematocysts of the specimen from Naples, however, are a little different in size, wherefore we might possibly consider it as a distinct variety to which also *elongatus* probably belongs (compare below!). The nematocysts of the column are few in the middle part of the body, in the distal part numerous. The mesogloea is of ordinary thickness. The endodermal circular muscles are not very much developed and form no separate sphincter. The sphincters which are mentioned by Hertwig in *clavus* and the distal sphincter, which Appellöf stated to be present, are nothing but local phenomena of contraction. The ectoderm of the tentacles is very high, the ectodermal muscles a little ramificated, but low, and the mesogloea of ordinary thickness; the endoderm is the thinnest layer. The ectoderm of the actinopharynx contains numerous, large, typical nematocysts, while the other nematocysts are few or very rare. It is devoid of ectodermal muscles. The siphonoglyphes are but slightly differentiated, as regards their histologic structure.

There are 6 pairs of mesenteries, of which 2 pairs of directives; they are all perfect and fertile. In younger specimens the 8 "*Edwardsia*-mesenteries" are stronger than the other mesenteries, what has been observed by Hertwig as well as by Appellöf, and what also I confirm. The longitudinal muscle-pennons are very strong, with high, and especially in older specimens, very ramificated folds in the reproductive region. In younger specimens the folds are less numerous in the reproductive regions or in the part where such folds are afterwards developed, but they are thicker than in older specimens. Thus the pennons of the "*elon-*

gatus"-specimens, reproduced in the textfigures 102—103, which were not sexually ripe, show fewer folds than the pennons of ripe *kerguelensis*-specimens (textfigs. 107—108), and the pennons of these latter specimens have considerably thicker folds than those of the larger ones from Greenland (Scoresby Sound), the Mediterranean and Kerguelen (Germ. Tiefsee-Exp.) (textfigs. 104—106). The conformity between the pennons of these latter specimens, and between these and the pennons of *purpurea*, is very great, and the pennons of these three forms (textfigs. 104—106) are on their inside furnished with low folds which were also traceable on the other reproduced sections, excepting the first one which has been taken from the youngest specimen. The outer lamellar part of the mesenteries is in all specimens attached close to the outer edge of the pennons. The parietal muscles, which are not expanded on the column, are strong and distinctly outlined in the reproductive region. In the textfigures 109—118 I have reproduced these muscles of several specimens from different localities. However varying their appearance may seem to be, it is common to them all that the folds of the muscles are weaker on the outside than on the inside. In the younger, not sexually ripe specimens the parietal muscles are extended and the folds not ramificated or only inconsiderably so. The extended form is distinctly conspicuous in *elongatus* (textfigs. 109, 113), but also in young specimens from Scoresby Sound, (textfig. 111, length and breadth of the animal about 0,5 cm — textfig. 110, length of the animal about 1,5 cm, breadth 0,45 cm). The parietal muscles of the Ingolf-specimen (textfig. 116) and those of the specimen from Naples (textfig. 115), of which the former are devoid of reproductive organs, the latter has such, are more broad than they are long, while the others are rather expanded. The parietal muscles of the largest specimens are the most richly ramificated, figs. 112, 115, 117, 118. Below the reproductive region, where the parietal muscles begin to fuse into the longitudinal muscle-pennons they are more expanded, as seen on the section from the Naples-specimen in textfig. 114. We thus find that the appearance of the parietal muscles in the reproductive specimens varies considerably in the reproductive region; in younger specimens the folds are less numerous, more thick and a little ramificated, in older ones more numerous, more thin and richly ramificated. In younger specimens the parietal muscles are besides more radially extended while in older ones they are more concentrated, a memento that we are not uncritically to put up new species, only on basis of a different appearance of the parietal muscles. The ciliated streaks are well developed and the intermediate streaks well differentiated. The median streak forms a direct prolongation of the longitudinal ridges of the actinopharynx. The cnido-glandular tract is very long. In several specimens I have observed a small oral stoma. Also a marginal stoma is present. The species is dioecious.

Remarks: As this species has played a certain part in zoogeographical respect I have above given a more than usually detailed description of its anatomy. I also would advise a stricter analysis of its rather intricate synonymy. The Antarctic forms are the first to be discussed. As regards *Actinia clavus* Quoy and Gaim. which several authors have placed in the genus *Halcampa*, it is evidently not identical with *Halcampa clavus* R. Hertwig, which Pax 1912, after having examined some types of Quoy and Gaimard, was willing to place together with the species of these authors. The difference in their anatomy is namely considerable. The presence of a single deep siphonoglyphe in the species of Quoy and Gaimard is enough to prove that we have to do with quite another genus than that of Hertwig. Andres (1883) has a more correct understanding of its systematic place as he names the former *Philomedusa* (= *Bicidium*) *clavus*, which name also



Textfigs. 109—118.
Halcampoides abyssorum.
Transverse sections of parietal muscles (Figs. 112, 115, 117, 118 in the reproductive tract).

Figs. 109—111, 113, 116 from not sexually ripe specimens (fig. 109 spec. from Bohuslän, fig. 110 spec. from Scoresby Sound, fig. 111 spec. from the same locality, fig. 113 spec. from Ireland). Figs. 112, 114, 115, 117, 118 from adult specimens. The section fig. 112 is the outer part of the mesentery reproduced in fig. 104. Fig. 114 spec. from Naples. The section has been taken close below the reproductive tract. Fig. 115 spec. from Naples; fig. 116 spec. from the Ingolf exp. Section in the uppermost part of the cnido-glandular tract; fig. 117. The section is the outer part of the mesentery, reproduced in fig. 107 spec. from Challenger Exp. = *H. kerguelensis* Hertw.; fig. 118 the very large spec. from the German Tiefsee Exp.

Mc. Murrich (1913, p. 969) adopts. That the species of Quoy and Gaimard is a larva of *Peachia* (= *Bicidium*) is very probable; I will, however, make the reservation that this species possibly may be the larva of a *Halolava* or of an *Eloactis*. Unfortunately the figure given by Pax[1], is of so small dimensions that we cannot form a clear conception of the relation between the longitudinal pennons and the parietal muscles (compare below the conditions in *Peachia* on one side, *Haloclava* and *Eloactis* on the other), nor of the structure of these latter. Judging by the figure the arrangement of the muscles rather seems to indicate that the species belongs to one of the two latter genera. This might be very easily decided by an examination of the apices of the tentacles and their nematocysts. There is no doubt that the type of Quoy and Gaimard belongs to some one of the above-named three genera.

Hertwig's *Halcampa clavus*, on the other hand, certainly is a species of *Halcampoides*. Concerning this species Haddon (1889, p. 336) has suggested that it is identical with Studer's *Halcampa purpurea*, to which Kwietniewski (1896, p. 588) objects, while Mc. Murrich (1913, p. 969) thinks that it may possibly be a larva of *Halianthella* (*Edwardsia*) *kerguelensis* (Stud.). The latter view is, to my mind, quite untenable, as there are pores in the physa of Hertwig's species, but no such in *H. kerguelensis*. Furthermore reproductive organs are developed in *H. clavus*, and therefore it cannot be a larva. Besides this, Hertwig has not observed any mesogloeal sphincter in his species, and he could not possibly have overlooked the well developed sphincter of *H. kerguelensis*. On the other hand, Haddon is, as far as I can see, quite correct in his opinion that *H. purpurea* and *clavus* of R. Hertwig are one and the same species. It is true that Kwietniewski emphasizes that *H. purpurea* is furnished with a single pore in the physa, while *clavus* has several such, but, as regards *purpurea* (compare above!), I do not think that this observation by Kwietniewski is exact, as the physa of both forms is perforated by several pores. The difference in size between the 8 "*Edwardsia*-mesenteries" and the 4 other mesenteries in *H. clavus*, in contradistinction to the uniform development of all mesenteries in *purpurea*, seems to me to be of little importance as also in the Northern forms I have found the 2 youngest couples, at least of younger individuals, to be weaker than the other mesenteries (Compare also Appellöf 1896, p. 13). *Halcampa clavus* of Hertwig and *H. purpurea* therefore to my mind are identical species.

A third Antartic species, *Halcampa kerguelensis* Hertw. also seems to me to be identical with *H. purpurea*. It is true that Hertwig has pointed out some characters which might serve to distinguish *clavus* from *kerguelensis*, but on closer critical inspection I come to the conclusion that these characters are insignificant. The slightly different structure of the pennons is probably connected with the different size of the specimens, furthermore the transverse-sections of the pennons of *H. kerguelensis*, reproduced by Hertwig, is in no wise typical. Such an arboriform shape of the middle part of the pennon I have never observed, although I have sectioned a couple of specimens (compare textfigs. 107, 108). The two sphincters which Hertwig describes in *H. clavus* do not deserve this name; to my mind, they are, as I have above suggested, only indifferentiated circular muscles concentrated through the contraction of the column in these parts. Also the different appearance of the actinopharynx in both species is certainly connected with a different state

[1] Pax (1914, p. 585) seems to adopt the opinion that the species of Quoy and Gaimard is a *Peachia*. He declares that he has proved this species to be a *Peachia*, which to my mind does not appear from his account.

of contraction, and the longitudinal furrows of the tentacles of *clavus* have no doubt arisen by an accidental, irregular contraction (compare above!). The longitudinal pennons of *H. kerguelensis* are not so richly ramificated as in *Halcampa purpurea*, and the folds are thicker than in the latter species which I have above proved to be identical with *H. clavus*, but this diversity is, in my opinion, due to the different age of the specimens (the specimens of *kerguelensis* were considerably smaller than those of *purpurea*). I therefore think that Hertwig's *H. clavus* and *kerguelensis* and Studer's *H. purpurea*, all dredged at Kerguelen, are the same species.

If we now turn to the Northern and Arctic Halcampoides-species, Appellöf (1896) has shown that *Fenja mirabilis* and *Aegir frigidus* are identical with *H. abyssorum*, a view which is correct, as far as I can see from Appellöf's description. In addition to Danielssen's species we have to recollect *H. septentrionalis*, a name proposed by Pax for *Halcampa clavus*, described by Tizard and Murray, from the channel of the Faroe Islands and, according to Haddon (1889, p. 336), identified by R. Hertwig as his *H. clavus*. As this form has been dredged in the cold area, it is very probable that it is identical with *abyssorum* (I have never seen this form myself); there is no reason to give a new name to this form, and Mc. Murrich (1913, p. 969) is of the same opinion. Finally we have to mention *Halcampoides elongatus*, a species which I have characterized in a few words (in Stephens 1912, p. 8) as having weaker and more elongated parietal muscles than *H. abyssorum*. As I have, however, afterwards found (compare above, textfigs. 110—111) that the parietal muscles in young, not adult specimens of *abyssorum* are provided with sparser folds and are more elongated in the part belonging to the reproductive region than in older specimens, I think that the supposed differences in the structure of the parietal muscles of *elongatus* and of *abyssorum* are connected with a disparity of age — the specimens of *elongatus* were young, not adult specimens, and I am probably not mistaken, if I place *H. abyssorum*, *septentrionalis* and *elongatus* together in a single species, *H. abyssorum*.

The question now remains, whether *Halcampoides purpurea* and *H. abyssorum* are identical or not. Almost all authors occupying themselves with this question, as Haddon, Mc. Murrich and Pax, have regarded the Antarctic and Arctic species of *Halcampoides* as distinct species — in fact no author has examined more than a few of the above-named species, but entirely founded his statements on descriptions from literature. Appellöf (1896) is the only author who has proposed Hertwig's *H. clavus* and Danielssen's *Halcampoides abyssorum* to be the same species; still R. Hertwig has identified *H. clavus* with the species signified as *H. septentrionalis*. With an interrogation-mark Appellöf has also put up *H. clavus* Quoy and Gaim. as synonymous with the former as well as with *Halcampa purpurea*. On the other hand, he keeps *Halcampoides kerguelensis* as a distinct species. After the account given above — I have had an opportunity to examine all species excepting *H. septentrionalis* — I do not doubt that they are all identical or, on all accounts, so nearly related that no specific character can be pointed out for them. The species therefore ought to be called *Halcampoides purpurea* (Stud.) Carlgr.

Thus we find here a species occurring now in deeper, now in more shallow water, common to the Arctic as well as the Antarctic regions, but, according to earlier accounts, absent in the intermediate waters. The latter account is, however, probably not correct; I am inclined to think that the species is to be regarded as a cosmopolitan, though it has its largest distribution in the cold area. The occurrence of the species in the

Mediterranean namely indicates its cosmopolitism. It is true that the nematocysts differ a little in size and occurrence from those of the Arctic and Antarctic specimens, but this difference is not so considerable as to make us want to put up a new species; it is possibly a separate race or variety (*mediterranea*) to which the not sexually ripe specimens, taken at the coasts of Bohuslän and Ireland, probably belong.

Genus **Acthelmis** Lütken.

Diagnosis: Halcampoididae without sphincter. Column expanded, smooth, without papillae, not divisible into regions or indistinctly so. Tentacles more than 12, not swollen in the apices. Siphonoglyphes absent or very feebly developed. 6 pairs of perfect, fertile mesenteries with longitudinal pennons. Sterile, imperfect mesenteries without pennons, in one or several cycles.

Lütken has for *Actinia intestinalis* Fabr. proposed the genus *Acthelmis*, but never given any diagnosis of the latter. In the Arctic regions there are two species, the only hitherto known. Probably the genus *Charisea*, described by Torrey (1902), is synonymous with *Acthelmis*, though this author places this genus to the family Actiniidae. The body-shape of *Charisea* namely indicates that the genus has no distinct pedal disc, and the figures given by Torrey of the muscles of the mesenteries and his description of the rest of the genus agree well with the above diagnosis of *Acthelmis*. It may besides be that the species *C. saxicola* is identical with anyone of the here described species of *Acthelmis*.

Acthelmis intestinalis (Fabr.) Lütken.

Pl. 1. Figs. 6—7.

Actinia intestinalis n. sp. Fabricius 1780, p. 350, figs. 11 A—C. Andres 1883, p. 588. ?Fleming 1828, p. 498, ?Sars 1835, p. 3. ?Johnston 1847, p. 219, textfig. 49. ?Landsborough 1852, p. 247. ?Norman 1868, p. 318.

A. (*Acthelmis*) *intestinalis* Fabr. Lütken 1875, p. 186.

Actinocereus intestinalis. Blainville 1830, p. 294, 1834, p. 328.

Diagnosis: Column in the proximal end rounded or sometimes flattened. Division into regions indistinct. Nematocysts of the column and tentacles 14—17 × 2—3 μ. Spirocysts of the tentacles unto 22 × 3 μ. Tentacles 18—26 with feebly developed longitudinal muscles. Nematocysts with distinct basal part to the spiral thread 17—22 × 4—5 μ in the ectoderm of the actinopharynx. 2 indistinct siphonoglyphes. Pairs of mesenteries 6 + 6 + 12, the latter cycle more or less perfect. Folds of the longitudinal pennons high, but not very numerous (on transverse-sections through the upper part of the reproductive region about 20, through the lower part about half the number) and ramificated mainly in the outer part. The lamellar outer part of the mesenteries issuing from the outmost end of the pennon. Parietal muscles weak, but expanded, with few, scattered, short and thin folds. Mesogloea in the parietal muscle-region thin. Expansion of the parietal muscles on the body-wall inconsiderable. Longitudinal muscles of the imperfect mesenteries of about the same structure as the parietal muscles of the perfect mesenteries, but a little stronger. Well developed ciliated streaks.

Colour: transparent yellowish-white, the proximal part with paler longitudinal lines (Fabricius).

Dimensions: Length in preserved state unto 2,8 cm, breadth 0,25 cm. Length of the tentacles about 0,25 cm.

Occurrence: West-Greenland. Godhavn (Olrik), Ritenbenk (Andersen), Egedesminde (Traustedt, Olrik).

Greenland without distinct locality (Holböll). On stones or shells at the shore, also on sand (Fabricius).

Further distribution: Shetland Islands (Fleming) (?Perhaps not this species).

Exterior aspect: In extended state the body is expanded and cylindrical; in very contracted state often broader in the proximal and distal ends. (Pl. 1, figs. 6, 7). Distinct pedal disc absent. It is true that the proximal end of some of the examined species is flattened disc-like, but a distinct outline between the most proximal part and the other part of the body is never to be observed. The proximal part is mostly a little involved in the preserved specimens, but never swollen as a physa generally is. The column is smooth, without papillae, divisible into two from each other very little differentiated parts, a longer scapus and a shorter capitulum; sometimes these regions seem to be separated from each other by a fold, recalling a fossa, which is probably due to the contraction of the body. The scapus seems to be able to generate a thin membrane which, however, may be a mucus-secretion. According to Fabricius the tentacles are 18 in number; in 6 species, examined by myself, the number varied from 24 to 26. The tentacles, arranged in three cycles, may be perfectly covered by the column; they are short, conical, not thickened in the apices and almost all of about equal length, the outer tentacles are only a little shorter than the inner ones. The oral disc is inconsiderable, with shallow, radial furrows. The actinopharynx is short, in the preserved specimens folded and supplied with two weak siphonoglyphes devoid of aboral prolongations.

Anatomical description: The ectoderm of the "scapus" is very high and provided with numerous mucus-cells and very sparse nematocysts ($14—17 \times 2—3\ \mu$ in size). The ectoderm of the capitulum differs from that of the scapus only in this respect that the mucus-cells are very sparse here. The mesogloea of the column is thin and fibrillated. The endodermal circular muscles are a little stronger in the abovenamed fold, but not forming any distinct sphincter there. The longitudinal muscles of the tentacles are weak, the spirocysts of the tentacles are very numerous and of variable length, to about $22 \times 3\ \mu$ in size. The typical nematocysts are sparse and of the same length as in the column. The ectoderm of the actinopharynx contains very numerous mucus-cells and numerous nematocysts with distinct basal part to the spiral thread. They are widened in the basal end and $17—22 \times 4—5\ \mu$ in size. The wall of the nematocysts in the tentacles and in the actinopharynx is comparatively thin. In the siphonoglyphes the mucus-cells are very sparse and the nematocysts absent or very sparse.

The mesenteries are hexamerously arranged, in three cycles. Of these cycles the latter is more or less perfect and only present in the distal part of the body. Thus the mesenteries of the third cycle of a specimen were developed in the dorso-lateral and the lateral exocoels, but not in the ventro-lateral exocoels. Besides this, the mesenteries of the third cycle end at a different level, even the mesenteries of one pair. Only the first 6 pairs are perfect and provided with pennons. Judging by the unequal size of the filaments the ventral mesenteries of the ventrolateral pairs are the younger, the dorsal mesenteries of the same pairs the older. The muscle-pennons are provided with high, mainly in the outer parts ramificated folds. In the upper part of the reproductive region, at some distance from the actinopharynx, there are, in transverse-section, about 20 folds (textfig. 119); in the lower part of the reproductive region they are less numerous (textfig. 120). The outer lamellar part of the mesogloea of the mesenteries issues from the exterior border of the pennon. The parietal muscles are but slightly developed. On the pennon-side the short and sparse folds of the parietal muscles merge into the longitudinal muscles of the pennon, now there are some rather close folds not far

Fig. 119

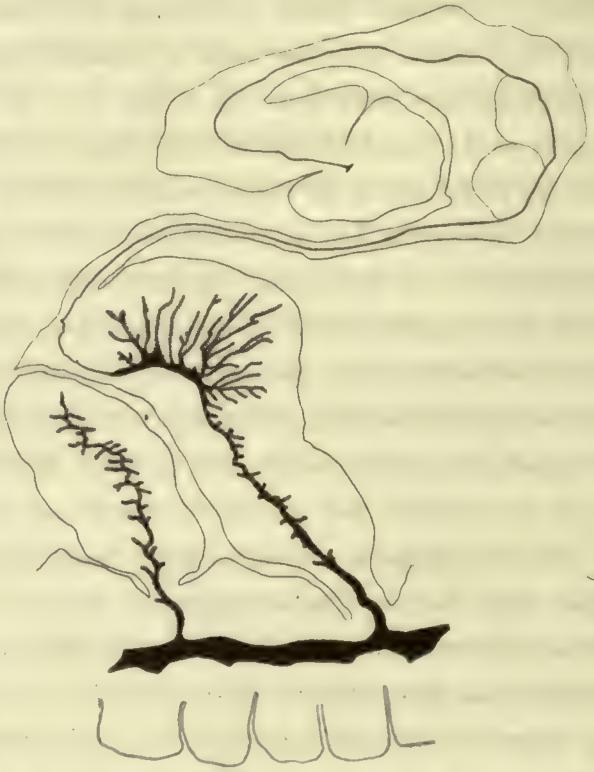


Fig. 120

Fig. 121

Textfigs. 119—121. *Acthelmis intestinalis*. Fig. 119: Transverse section through a perfect mesentery in the uppermost part of the reproductive tract. Fig. 120: A similar section farther down through mesenteries of the first and second order. Fig. 121: A similar section of a mesentery of the second order.

from the pennons, now some higher folds are developed in the middle part of the lamellar region of the mesenteries between the column and the pennon (fig. 119). On the side of the mesenteries opposite to the pennon the parietal muscles form some sparse folds (textfig. 120), further upwards the folds are still sparser, until at last they disappear, and a straight muscle-lamella remains. In the region of the ciliated streaks the parietal muscles are of the same appearance (textfig. 119). The mesenteries of the second cycle are weak, and their muscles with the sparse folds recall on transverse-sections the parietal muscles of the mesenteries of the first cycle in the lower part of the reproductive region (textfig. 121). The mesenteries of the third cycle are still more weakly developed. On transverse-sections I have observed one stoma in the vicinity of the actinopharynx. The mesenterial filaments are provided with well developed ciliated and intermediate streaks. Only the first 6 perfect mesenteries have reproductive organs.

Remarks: The Greenlanders call this species "Kettuperangsak" (Fabricius).

Acthelmis schaudinnii n. sp.

Diagnosis: Column thicker and more robust than in *A. intestinalis*, and, according to the different state of contraction, cylindrical or oval. Column not divisible into distinct regions. Typical nematocysts of the column 14 × 2 μ, those of the tentacles 22—26 × 2—4 μ, those of the actinopharynx 20—23 × 1,5—2 μ. Nematocysts with indistinct basal part to the spiral thread, widened in their basal end, in the tentacles 24—26 × 1,5—2 μ, in the actinopharynx 24—29 (36) × 5—(6) μ. Number of tentacles about 34. Longitudinal muscles of the tentacles weak. Siphonoplyphes? Pairs of mesenteries 6 + 6 + an imperfect third cycle; the folds of the pennons high and rather much ramificated, more numerous than the former species, in the reproductive region about 20—30. Insertions of the lamellar part of the mesenteries as in *A. intestinalis*. Parietal muscles weak with large, not numerous, low folds. Mesogloea in the region of the parietal muscles thick. Expansion of the parietal muscles as in the former species. Muscles of the mesenteries of the second cycle, although stronger, recalling the parietal muscles of the first cycle.

Colour?

Dimensions: Species from Great fiord: length 1,3 cm, largest breadth 0,6 cm, length of the tentacles about 0,3 cm. — A specimen from New-Zembla: length 0,8 cm, breadth 0,5 cm.

Occurrence: Spitzbergen. Great fiord Cape Blanck 77°49′ N. 20°3′ E. 65 m (Rømer & Schaudinn 1898) 1 sp.

New-Zembla Besimennaja Bay. clay, 4—5 fms. (Nordenskiöld-Exp. 1875) 4 sp.

Exterior aspect: All the specimens were more or less contracted, the proximal as well as the distal ends were drawn in. According to the state of contraction the individuals were cylindrical or more fusiform, the diameter in proportion to the length is, however, in this species considerably larger than in *A. intestinalis*. The column does not seem to be divisible into regions, and its surface is smooth. The insertions of the mesenteries were rather distinct and corresponding to weak longitudinal furrows on the column, which are conspicuous on the involved distal part. The number of tentacles in the specimen from Great fiord was 34. The tentacles were hexamerously arranged and short, as in the former species. The oral disc is inconsiderable. The actinopharynx is of about twice the length of the tentacles, and longitudinally and transversely sulcated. I cannot with certainty decide whether siphonoglyphes are present or not, they are, at all events, weakly developed, if present, and form no aboral prolongations.

Anatomical description: The ectoderm of the column is provided with scattered nematocysts, partly typical, always of equal breadth and about 14 × 2 μ in size, partly widened in the basal end and larger, 24—26 × 5 μ; the ectoderm also contains very numerous mucus-cells. The ectoderm is thicker than the mesogloea, especially in the specimens from New-Zembla. The endodermal circular muscles of the column are weak and form no sphincter. The longitudinal muscles of the tentacles are weak and endodermal, the nematocysts of the ectoderm are 22—26 × 1,5—4 μ in size, — the breadth variates considerably, so that it is probable that there are two different sizes of capsules. The spirocysts are unto 30 (36) μ long. The radial muscles of the oral disc are weak. The ectoderm of the actinopharynx is high, with numerous nematocysts. The straight, riblike nematocysts, reaching a size of 22—24 × almost 2 μ, are the most numerous, those which are a little widened in the basal end and show a small, discernible basal part to the spiral thread, are somewhat sparser, their size is commonly 24—29 × 5 μ, rarely unto 36 × 6 μ. Besides these, I have here found sparse, sometimes a little curved, nematocysts of about 29 × 3 μ in size.

The mesenteries are hexamerously arranged in three cycles, 6 + 6 + 12, the latter cycle is imperfect. There are two pairs of directive mesenteries. The first six pairs are perfect and provided with well developed filaments with ciliated streaks. The six pairs of the second cycle are imperfect and of full body-length like the mesenteries of the first cycle, at least several of the mesenteries of the second cycle bear distinct, although not long, filaments. The mesenteries of the third cycle are very weak and only rising a little over the endoderm of the column. Only the first six pairs have pennons; the sixth pair — the ventral mesenteries of the ventro-lateral pairs — is the weakest. The longitudinal pennons are much stronger than in *A. intestinalis*. The folds are high and rather richly ramificated. A transverse-section of a pennon in the lower region of the actinopharynx of the specimen from Great fiord is reproduced in the textfig. 122. (The side of the actinopharynx is turned upwards). In the tract of the reproductive organs the folds are very high and partly much ramificated (textfig. 123, transverse-sections of the specimen from Great fiord). The parietal muscles are weak, the folds are thick, few and low, and recall those of the muscles of the mesenteries of the second cycle, though the folds are stronger here. The mesogloea is strongly developed in the parietal muscle-tract as well as in the mesenteries of the second order, wherefore these part in transverse-sections are of a more robust appearance than the corresponding tracts of *A. intestinalis*. (The textfigure 124 shows a transverse-section through a mesentery of the second order of a specimen from New-Zembla). The parietal muscles seem to be sparsely spread over the column. Stomata are probably present in the distal part of the mesenteries. Only the first six pairs of mesenteries bear reproductive organs. The specimen is dioecious.

Fig. 122

Fig. 123

Fig. 124

Textfigs. 122—124.
Actinernus schaudinnii.
Fig. 122: Transverse section of pennon in the lower part of the actinopharynx. Fig. 123: A similar section in the reproductive tract. Fig. 124: Transverse section of a mesentery of the second cycle.

Remarks: The state of preservation of the specimens was not good, wherefore the description is not as perfect as desirable. It, however, seems to me that the species is distinctly separated from the former species. In its organisation it moreover recalls *Haliactis arctica* (p. 129), but as I have not observed any acontia here, it is no more to be referred to this latter genus.

Genus **Peachia** Gosse.

Diagnosis: Halcampoididae with a well-developed, rounded, aboral body-end, physa, perforated by very numerous apertures (in twelve longitudinal rows Haddon). Column more or less cylindrical, often of considerable length, smooth, without "*Halcampa*-papillae", indistinctly divided in regions, without spirocysts and sphincter. Tentacles 12, not hemispherically swollen in the apices, the inner (endocoel-tentacles) shorter than the outer (exocoel-tentacles). A single, very deep and well differentiated siphonoglyphe with well-developed aboral prolongation. Oral end of the siphonoglyphe drawn out in a more or less lobated socalled conchula. Pairs of mesenteries 10 (6+4 lateral and ventro-lateral pairs). Only the mesenteries of the first cycle perfect, fertile with filaments and with strong pennons passing into the parietal muscles without distinct outline. Mesenteries of the second cycle with well-developed, almost pennon-like, muscle-bundles in the endocoels.

This genus is evidently most nearly related to *Eloactis* and *Haloclava*. Synonymous with *Peachia* is the genus *Siphonactinia* of Danielssen and Koren, as before pointed out by several authors. In conformity with Haddon (1887, p. 475) I also think that *Peachia* and *Bicidium* are synonymous. This latter genus, living parasitically on medusae, is only distinguished from *Peachia* by the mesenteries of the second order not being developed. These mesenteries seem to originate very late in *Peachia*. I have namely found a specimen of *Peachia* in the clay, the mesenteries of the second order of which were not developed (compare below under *Peachia hastata*). This case seems to be prevailing in *Eloactis*. A specimen of *E. mazelii* from a depth of 40—50 fms., taken in the Hjälte fiord Norway, shows very weak mesenteries of the second cycle in only a single exocoel (compare *E. mazelii* textfig. 142). Furthermore it ought to be remembered that reproductive organs are never found in the genus *Bicidium*, which is probably nothing but a larva-stadium of *Peachia*. The conchula, not always observed in *Bicidium*, also seems to appear very late, and probably alters its form while developing. Under such circumstances it is only with a certain reservation that the form of the conchula may be used as a species-character in *Peachia*.

Mc. Murrich (1893, p. 145) states that *Peachia koreni* has only 8 tentacles. It is, however, probable that the animal was a larval form with undeveloped reproductive organs, as also supposed by Mc. Murrich.

Peachia parasitica (L. Agas.) Verr.

Bicidium parasiticum n. sp. Agassiz 1861, p. 24, 1865, p. 15. Verrill 1864, p. 31, Pl. 1, figs. 14, 15. Mc. Murrich 1913, p. 969. Hargitt 1914, p. 239, fig. 2.

Philomedusa parasitica (Agass.) Andres 1883, p. 324.

Peachia parasitica Verrill 1866, p. 338, 343, 1874, p. 739. Carlgren 1906, p. 83, figs. 7 a, b (a more complete list of the literature is given in the latter work).

Diagnosis: Nematocysts in the ectoderm of the column 25—29 (34) × 3,5 μ, in the tentacles 29 —39 × 4—5 μ, in the actinopharynx 29—41 × 4—5 μ, Spirocysts of the tentacles about 17—26 × 2,5 μ. Longitudinal muscles of the tentacles well developed. Conchula with three lobes, in extended state large, in contracted more or less distinct. Muscle-pennons in the mesenteries of the first cycle strong, expanded over almost the whole breadth of the mesenteries. The folds of the pennons rather high, in transverse-sections pectinate. Parietal muscles weak, not expanded on the column. Oral stomata and small marginal stomata present.

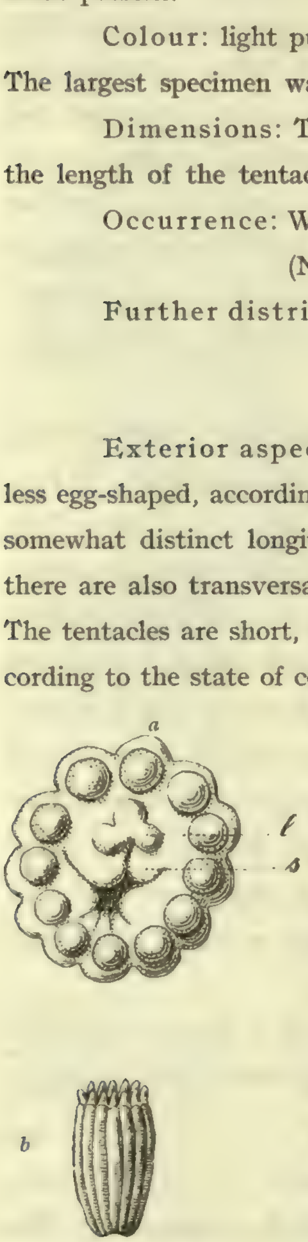
Colour: light purplish brown with bluish iridescence, similar to that of *Cyanea arctica* (Verrill). The largest specimen was brownish, in alcohol.

Dimensions: The largest specimens dissected by myself were 3,5 cm long and 2,5—3 cm broad; the length of the tentacles about 0,9 cm.

Occurrence: West-Greenland Egedesminde (Levinsen 1877) 1 sp., Nordre Strømfiord, St. 9 a (Nordmann) 1 sp., Greenland without distinct locality (Fasting).

Further distribution: North America from Cape Cod to Fundy bay. Nahaut Mass. to Eastport Maine (Verrill), Arctic ocean to Cape Cod (Parker) as larva on *Cyanea arctica*, as adult at Eastport Maine (Verrill).

Exterior aspect: The specimens were rather well preserved. The form of the body was more or less egg-shaped, according to a strong contraction of the distal and basal ends. The column is smooth with somewhat distinct longitudinal furrows corresponding to the insertions of the mesenteries; besides these, there are also transversal furrows produced by the contraction of the column. A distinct fossa is present. The tentacles are short, cylindrical, with a porus in the apex, and more or less longitudinally sulcated, according to the state of contraction. The number of the tentacles is 12. In the largest specimen one tentacle was invaginated. The oral disc is not particularly wide. The lobes of the conchula were indistinct in two specimens. In the largest specimen a little protuberance of the conchula is seen near the middle-line on one side; on the other side a similar elevation is probably present, though I cannot confirm it with certainty as the conchula was a little damaged here. In the second specimen the conchula was strongly contracted so that no distinct lobes are visible, in the third specimen it was of the same appearance as on the figure given by Verrill (1864) (Fig. 125 a).



Textfig. 125.
Peachia parasitica.
Fig. 125 *a* seen from the oral disc. *l*: conchula, *s*: siphonoglyphe. Fig. 125 *b* seen from the side, after Verrill 1864.

The actinopharynx is long, in proportion to the length of the body, and provided with a very well developed siphonoglyphe, the aboral prolongation of which almost equals the length of the actinopharynx. The actinopharynx is longitudinal and transversally sulcated, the transversal furrows are certainly a result of the contraction.

Anatomical description: The ectoderm of the body-wall is high and thicker than the mesogloea. The stratum of nerve-fibrillae and nerve-cells are distinct in the distal part of the ectoderm of the column; in the other parts it is not so much developed. I have measured the nematocysts (n) and the spirocysts (*sp.*) in the different regions of two specimens (*a.* specimen from Nordre Strømfiord, *b.* specimen taken by Fasting). They differ considerably in size from those of *Peachia hastata* and *boekii*. The size of the capsules was as follows:

	Column *n.*	tentacles *n.*	tentacles *sp.*	actinopharynx *n.*
in spec. a	25—29 (34) × 3,5—4 μ	32—36 × 4—5 μ	19—26 × 2,5 μ	35—41 × 4—5 μ
in spec. b	25—29 × 3,5	29—39 × 4 (5)	17—22 × 2,5	29—41 (commonly 36) × 5

In the specimen a. the nematocysts were typical with invisible basal part to the spiral thread; in the specimen b. the basal part was discernible. Probably this difference is due to the preservation of the capsules. The nematocysts are numerous in all regions; the spirocysts of the tentacles comparatively few. The endodermal circular muscles of the column are rather strong, but form no sphincter. The ectodermal longitudinal muscles of the tentacles are well developed. The ectoderm of the siphonoglyphe is devoid of nematocysts, and its albumen-cells are few in comparison with those of the actinopharynx, which has no longitudinal muscles. The number of the mesenteries is that typical of *Peachia*. In one specimen one dorso-lateral pair of mesenteries is weak and a little coalesced with the actinopharynx. It is expanded in aboral direction a short distance below the actinopharynx (compare below the description of a young specimen of *Peachia hastata*!) The muscles of the mesenteries mainly are of the same appearance as in other *Peachia* species. The longitudinal muscles, however, form no concentrated pennons in the region of the glandular streak, but are spread over almost the whole breadth of the mesenteries (textfig. 127), wherefore the pennons look more like a ribbon. The folds are rather high and mainly of about equal height, here and there with certain interspaces; there are, however, also lower folds. In transverse-sections the pennon recalls a comb. The pennon merges into the parietal muscles without distinct limit. Below the region of the filaments the pennons are more contracted (textfig. 126). The parietal muscles are weak with few and low folds, on the pennon-side not distinctly differentiated from the pennon, on the opposite side distinctly limited, but not reaching the distal end. They are not expanded on the column. The mesenterial filaments are of typical appearance and only developed in the mesenteries of the first cycle. Stomata are present on the perfect mesenteries. The oral stomata are large, but the marginal stomata very small and placed in the vicinity of the oral disc. I have not observed any reproductive organs in the specimens I have sectioned.

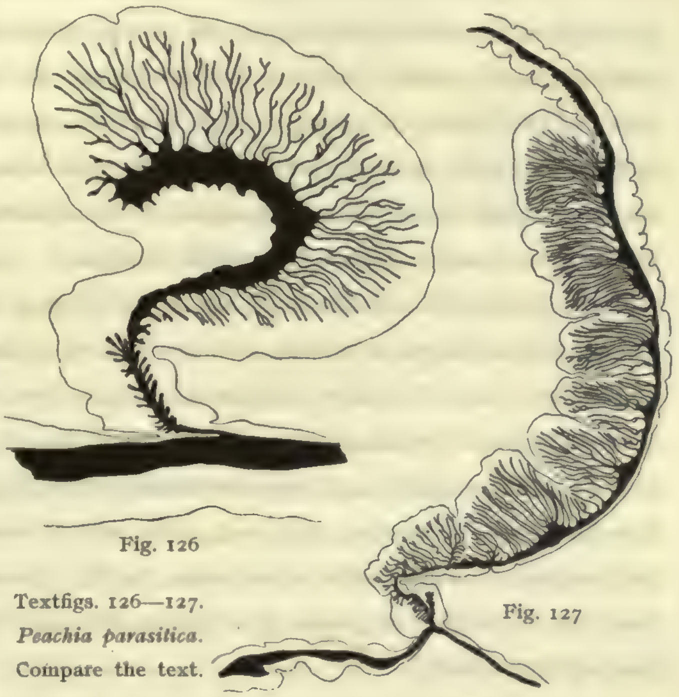


Fig. 126

Fig. 127

Textfigs. 126—127. *Peachia parasitica.* Compare the text.

Peachia hastata Gosse.

Pl. 1, figs. 21—29. Pl. 2, fig. 13.

Peachia hastata n. sp., Gosse 1855, p. 267, Pl. 28.

— — Gosse, Haddon and Dixon 1885, p. 399—405, Pl. 16 (in this work synonymy and literature to 1885). Haddon 1889, p. 338—340, 1 textfig. Faurot 1895, p. 94—110, figs. 7, 8, 10—15, Pl. 1, figs. 1—3, Pl. 2, figs. 3, 5, Pl. 3, figs. 3—6, Pl. 5, fig. 6, Pl. 6, fig. 5, Pl. 7, Pl. 9, Pl. 12, textfig. 12. Carlgren 1904, p. 538, textfigs. 2, 4, 1906, p. 81, fig. 6, a—h (Literature of the larvae). Nafilyan 1912, p. 9. Mc. Murrich 1913, p. 967.

Diagnosis: Nematocysts in the ectoderm of the column 12—16 × 2 μ, in the tentacles 17—22 × 2—2,5 μ, in the actinopharynx 19—24 × 2 μ. Spirocysts in the ectoderm of the tentacles 12—19 μ. Longitudinal muscles of the tentacles well developed. Conchula large with 6 to 10 lobes. Pennons of the mesenteries of the first cycle strong, spread over the greater part of the breadth of the mesenteries. Folds high, in the outer part arranged more or less like palisades, in the inner part often ramificated. Parietal muscles weak with only a few folds. Pennons of the mesenteries of the second cycle comparatively strong with high folds. Oral stomata present. Marginal stomata?

Colour: The most distal part of the column, "capitulum" and the "physa" in adult specimens translucent, flesh-coloured or almost salmon-coloured, usually richly splashed with reddish-brown in irregular, longitudinal lines. Tentacles translucent, pinkish or very pale purplish-brown, on the inside with 4—5 more or less distinct W marks and bands. The back of each tentacle has an opaque white spot about halfway between the base and the tip. Oral disc pinkish-white, inter-radial lines with brown and white spots and marks. Conchula flesh-coloured or pale pink, lobes with a brown or deep-red core, usually with a white apical spot. Actinopharynx with twelve dark-brown bands, alternating with broader orange-buff bands, further down the colour is reddish or purple (Haddon & Dixon 1885, p. 401—402; in this work a more complete description of the colour).

Dimensions: Length of the body 2,5 to 10 cm in contracted state, in expanded state unto 20,5 cm. Breadth 1—2 cm (Haddon & Dixon). The length of the tentacles about equal to the diameter of the column.

Occurrence: Denmark. Frederikshavn (Schmidt 1872) 2 large specimens.

Sweden. Gullmar fiord (Theel and Carlgren 1905. Larvae on hydroid-medusae, and a small specimen on the clay in "Bondhålet"), Vinga 50—0 m. Gullmar fiord 75 m. Koster fiord 230—0 m (Björck 1910, Larvae on hydroid-medusae).

Further distribution: North-Sea. Heligoland to British Isles. NW. France. Roscoff, Douarnenez bay, Lannion, Banyuls-sur-Mer.

Exterior aspect: The body is elongated and the column without distinct division in regions. In the expanded state of the animal, physa, capitulum and scapus — according to Haddon and Dixon — are to be distinguished. Any distinct limit, especially between the capitulum and the scapus, hardly existing, it seems to me rather arbitrary to make this distinction. The "physa" is ampullaceous in expanded state and perforated by numerous apertures, arranged in 12 longitudinal rows (Haddon 1889, p. 337); it may be perfectly involved. The column is rugose in contracted state, in expanded smooth. According to Haddon and Dixon 1885, p. 401) it is furnished "with numerous minute suckers." I have carefully examined specimens received from Haddon; they were in certain parts of the body strongly expanded, partly in transverse-sections, partly in preparations in toto in glycerine. As far as I can make out there are no "suckers", nor such low elevations as on the column of *Eloactis*. It seems to me that the "suckers", which nowise deserve this name, are nothing but cell-accumulations containing some more supporting cells than the other parts of the ectoderm. By an examination of the surface of the column, in preparations in toto, it is namely clearly seen that the main part of the mucus-cells form an irregular net-work, between which are distributed some more compact parts of the ectoderm, mainly consisting of supporting cells, but also of scattered mucus-cells.

The tentacles are 12, arranged in two cycles, the inner tentacles are shorter than the outer ones and issue from the endocoels, while the latter are exocoel-tentacles, an arrangement distinctly appearing in the larvae, but also visible in the adult animal. Thus I cannot agree with Haddon and Dixon that the tentacles are monocyclic. On the other hand, the description of the arrangement of the tentacles given by Faurot (1895) is exact. (Compare also Carlgren 1904). As to their form they are cylindrical, a little attenuated towards the apex and of about the same length as the diameter of the body. The oral disc is smooth, flattened and provided with radial furrows corresponding to the insertions of the mesenteries. The mouth is wide, in live animals commonly covered by the conchula.

The conchula is strongly developed, consisting of three main lobes, one in the directive plane and two lateral ones. From these smaller lobes tentacle-like prominences issue, so that the total number of lobes varies from 6 to 10 (Haddon and Dixon), according to the age of the animal. In the larvae and young specimens only the main lobes are developed (compare below!). The other part of the siphonoglyphe is very deep, distinctly differentiated from the other part of the actinopharynx, smooth, not wrinkled, and provided with a very long aboral prolongation which is twice as long as the main part of the actinopharynx. This latter is comparatively short, of about the same length as the diameter of the body, longitudinally sulcated, and in contracted state also with transversal folds. On the side of the aboral prolongation of the siphonoglyphe the actinopharynx is continued as narrow lamellae (compare below!).

Anatomical description: The anatomy of the adult species is described by Haddon (1889) and Faurot (1890, 1895). The latter (1895, p. 94) gives a more detailed description of the species, with numerous figures of sections through different parts of the body. Besides this, Sedgwick 1884, p. 43) has published some anatomical details of the species. In some respects the anatomy is, however, imperfectly described. For anatomical examination I have used partly a specimen from Frederikshavn, partly and mainly specimens from Ireland, dredged by Haddon, partly the sections made by Haddon who has placed them at my disposal.

The ectoderm of the column is ordinarily developed, in the contracted state of the animal thick and furnished with numerous mucus-cells, arranged as I have shown above. Its nematocysts are not numerous, and 12—16 × about 2 μ in size. The mesogloea is longitudinally and transversally stratiform as in *Halcampa*, and of ordinary thickness. The endodermal circular muscles are rather well developed, but form no sphincter.

The ectoderm of the tentacles is high and contains numerous, small nematocysts 17—22 × 2 (2,5) μ in size, and very numerous spirocysts, 12—19 μ long. The ectodermal muscles of the tentacles are weak.

The ectoderm of the actinopharynx is thick, folded and provided with nematocysts 19—24 × 2 μ in size, often a little curved, widened in the basal end, and with indistinct basal part to the spiral thread. Besides these, there are, in addition to supporting cells, also mucus-cells here, considerably broader than those of the siphonoglyphe. The ectoderm of the siphonoglyphe is thicker than in the other part of the actinopharynx, and composed of supporting cells with long cilia. At the basis of the ectoderm there are rather numerous, long, granulous glandular cells, which are in communication with the surface of the ectoderm through a narrow duct. At the transition between the siphonoglyphe and the actinopharynx the ectoderm is a little differentiated. The supporting cells carry stronger cilia here than in the other parts of the actinopharynx and the siphonoglyphe, and the nuclei commonly are more elongated, while they are round in the other parts of the actinopharynx and the siphonoglyphe (Pl. 2, fig. 13). Some cells of this zone might, however, be ordinary supporting cells, as round nuclei are also visible here and there. These strongly ciliated ribbons are comparatively broad at the oral side, but gradually become narrower and seem to end at some distance from the lower edge of the aboral prolongation. Probably these strongly ciliated parts are of some particular physiological importance, as they form a boundary between the siphonoglyphe and the other part of the actinopharynx. The mesogloea of the siphonoglyphe is considerably thinner than the ectoderm, but thicker than that of the actinopharynx proper. The endoderm of the siphonoglyphe is strongly vacuolated and very high in the exocoel-parts, in the actinopharynx proper lower and not so rich in vacuoles. A distinct stratum of nerve-fibrillae with few nerve-cells and a weak longitudinal muscle-layer is present in the ectoderm of the siphonoglyphe and the actinopharynx. The conchula with its hollow prominences is built as the siphonoglyphe. The aboral prolongation of the siphonoglyphe also contains parts of the actinopharynx itself. On both sides of the middle part of the prolongation, consisting of the siphonoglyphe, the actinopharynx is namely continued, forming two, in proportion to the plane of the actinopharynx, perpendicular lamellae, the free edge of which are more or less strongly recurvated (figs. 132, 133). The middle part of the prolongation is built as the siphonoglyphe in its upper part, while the ectoderm of the perpendicular lamellae is longitudinally folded as in the actinopharynx, and of the same structure as that; the ectoderm of the recurvated part is smooth, but does not seem to differ in structure from that of the folded part. The boundary zone (fig. 132 a) and the folded part gradually become narrower aborally, and at last disappear (fig. 133). The stratum of nerve-fibrillae, the ectodermal longitudinal muscles and the structure of the endoderm and the mesogloea agree with those of the actinopharynx. In the recurvated lamellae the endodermal muscles seem to be longitudinal, I cannot, however, decide it with certainty as my material has fallen short. Concerning the relation of the aboral prolongation to the filaments compare below!

The number of mesenteries is that typical of *Peachia* viz 6 pairs of perfect and 4 pairs of imperfect mesenteries, the latter in the lateral and ventro-lateral exocoels. Among the perfect mesenteries the ventral directives are the stronger, the dorsal directives the weaker (always?). Below the actinopharynx the inner part of the pennons of the directive pairs is strongly curved towards the endocoels, in the other pairs towards the exocoels. The pennons of the perfect mesenteries are strong, with numerous high folds

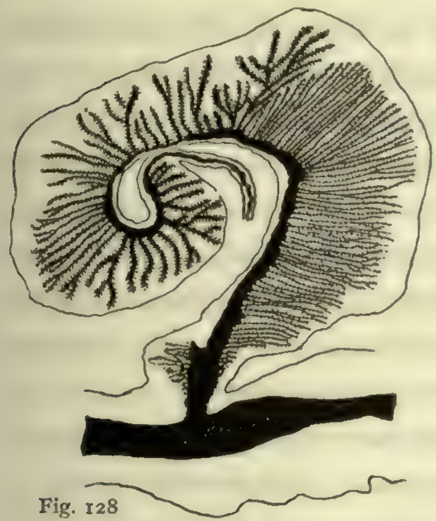


Fig. 128

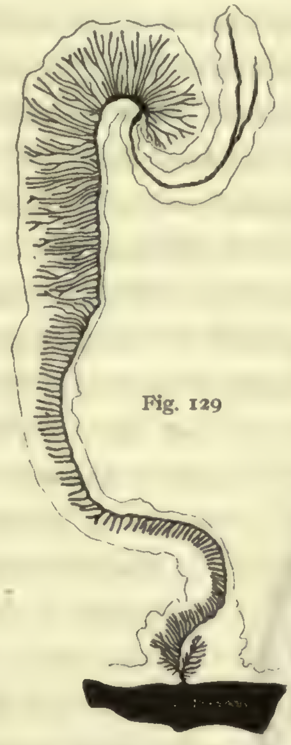


Fig. 129

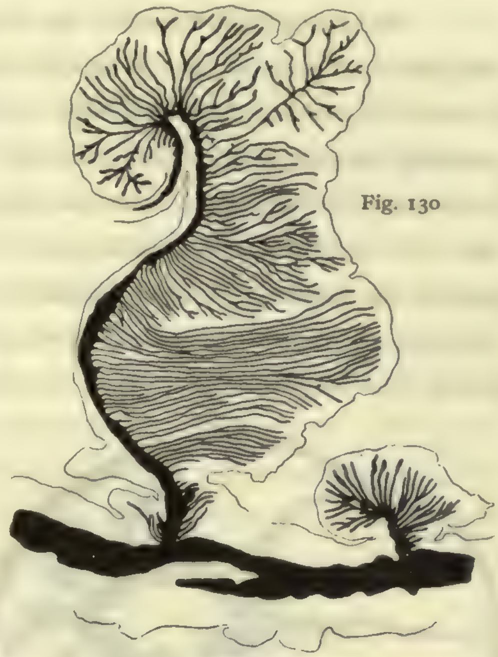


Fig. 130

Textfig. 128—133.
Peachia hastata.
Transverse sections of pennons of perfect mesenteries in the reproductive tract (fig. 128, 130, 131) and in the cnido-glandular tract (fig. 129). In the figure 130 also an imperfect mesentery is reproduced (to the right). The pennon in fig. 130 is from a ventral directive; the pennon reproduced in fig. 131 is from the same section as the mesentery in fig. 130. Figs. 132, 133. Transversal section of the aboral prolongation of the siphonoglyphe, fig. 132 in the upper, fig. 133 in the lower part. Both sections drawn under the same magnification *a* boundary zone *dm* ventral directives.

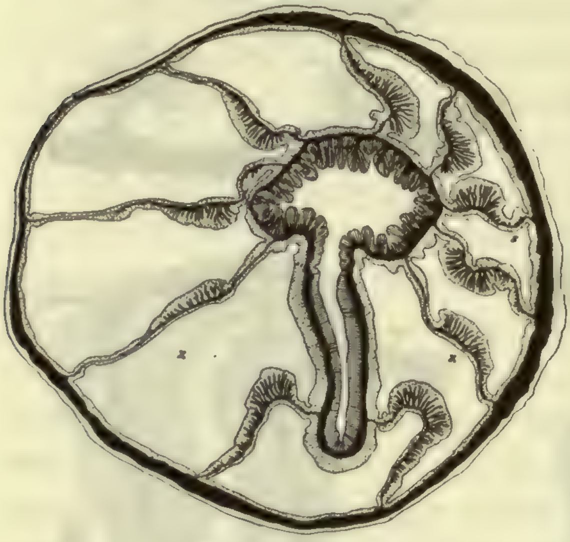
Fig. 131

Fig. 133

Fig. 132

of very variable appearance. In the textfigure 130, a directive mesenterium and a mesenterium of the second cycle are sketched in the reproductive region, the text figure 128 shows a transverse-section of a perfect mesenterium in the vicinity of the sections reproduced above, and the textfigure 129 a perfect mesenterium in the region of the glandular tract (the last section has been taken from another individium having no reproductive organs). Commonly the inner part of the pennons is more ramificated than the outer part. The longitudinal pennons and the parietal muscles fuse together without distinct limits. The part of the parietal muscles on the opposite side of the pennons is weak, distinctly definite, with the strongest folds on the inside. The mesenteries of the second cycle have produced small pennon-like formations, close to the insertions of the mesenteries. The inner parts of these formations are curved towards the exocoels, the parietal muscles are not particularly differentiated here. The parietal muscles are not spread over the column.

The mesenterial filaments are only present on the mesenteries of the first order. The ventral directive pairs are, however, devoid of ciliated streaks. Below the aboral prolongation of the siphonoglyphe the filament namely begins as a weakly developed, single cnido-glandular streak of inconsiderable dimension, gradually growing thicker and attaining its largest dimensions in the reproductive region. As in certain Zoantharia (for instance *Isozoanthus giganteus*) and in the Ceriantharia the ciliated streaks have probably here fused with the aboral prolongation of the siphonoglyphe and the actinopharynx, though the different parts of the filaments of the prolongation cannot be distinctly traced. Possibly the continuation of the siphonoglyphe and the recurvated part correspond to the ciliated streaks, the folded parts to the cnido-glandular streak. The imperfect mesenteries are devoid of filaments. The ciliated streaks are of typical appearance.



Textfig. 134. *Peachia hastata*. Transverse section of a young anormal specimen.

Only the mesenteries of the first cycle are fertile. The species is dioecious. The ovae are provided with a covering, decked by spines.

Larvae. (Synonymy and literature, compare Carlgren 1906, p. 81).

The larvae of this species, living on several hydroid-medusae, have been anatomically described before by myself and by several other authors, wherefore I do not give any details of its anatomy here. The younger stadia with only 3 couples of mesenteries are disc-like (Carlgren 1906 fig. 6*a*). Somewhat older stadia are a little more rounded, still older ones are more elongated and acuminated in the aboral end, only in the adult animal the body is cylindrical. The exterior aspect of the larvae in different stadia I have shown 1906 (textfig. 6). On the plate 1, figs. 21—29 I have completed the series (all larvae sketched on the same scale). The arrangement of the tentacles I have described before (1904). The first eight visible tentacles are distinctly seen on fig. 25, Pl. 1. On fig. 26 *b*, Pl. 1 two of the younger tentacles are conspicuous. In the older larvae a three-lobed conchula little by little appears, which I have been able to state by feeding larvae during two months in an aquarium. A specimen dredged by myself on the clay (figs. 28, 29, Pl. 1) also had a three-lobed conchula, but only 10 tentacles. This reduced number of tentacles is associated with an abnormal development of the mesenteries (compare below!). The colour of the column of the older larvae was opaque-white, the shades of colour pretty well agree with those of figure 5, Pl. 17 in the work of Haddon and Dixon (1885). Therefore I have no doubt at all that the larvae belong to *Peachia hastata*. With *P. boeckii* they cannot be identical as the colour of *P. boeckii* is another, and this species also in other respects is different from *P. hastata*. That only 3 lobes are developed in the larvae may be referred to the small size of the animals. Evidently these three lobes correspond to the three main lobes of the adult *P. hastata* which later on, as the animal grows in size, develop a few or many secondary lobes.

Concerning the appearance of the mesenteries, those of the 5th and 6th couples seem to originate in the typical places, so that the former form pairs with the dorso-lateral, the latter with the ventro-lateral

"*Edwardsia*-mesenteries." In connection with the appearance of the tentacles these couples arise much nearer to the lateral "*Edwardsia*-mesenteries" than it is otherwise commonly the case in the Actiniaria. An older larva, sectioned in series, shows no filaments on the 6th couple and weak filaments on the 5th couple; the filaments of the dorsal directive mesenteries were a little longer than those of the 5th couple; the ventro-lateral "*Edwardsia*-mesenteries" were provided with the longer filaments; the dorso-lateral "*Edwardsia*-mesenteries" had a little stronger filaments than the dorsal directives. The length of the filaments of the ventral directives was about equal to that of the dorso-lateral "*Edwardsia*-mesenteries", but the former filaments reach about as far down as those of the ventro-lateral "*Edwardsia*-mesenteries."

The abnormally developed specimen with only 10 tentacles, of which I give a transverse-section through the region of the actinopharynx (textfig. 134), had only 10 mesenteries. On one side of the directive plane the mesenteries were typically developed, on the opposite side one pair was totally missing. The mesenteries marked with *x* are provided with weaker filaments than the other mesenteries. The strongly ciliated boundary streak between the siphonoglyphe and the actinopharynx, occurring in adult specimens, is not distinctly differentiated here.

Peachia boekii (Dan. & Koren.) Hadd.

Pl. 1. Fig. 30.

Siphonactinia Boekii n. sp. Danielssen and Koren 1856, p. 88, Pl. 12, figs. 4—6.
— — Dan. & Kor., Milne-Edwards 1857, p. 236. Andres 1883, p. 320, fig. 8.
Peachia — (Dan. & Kor.), Haddon 1887, p. 475. Mc. Murrich 1915, p. 969.

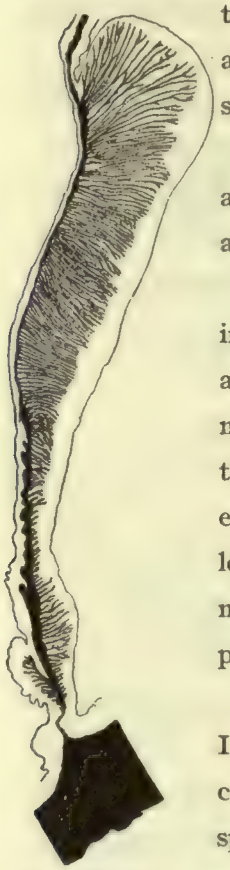
Diagnosis: The nematocysts in the column 14—17 × (1,5)—2 μ, in the tentacles 19—29 × 2—2,5 μ, in the actinopharynx 24—26 × 3,5—4 μ. The spirocysts of the tentacles 14 × 1,5—26 × 2,5 μ. Longitudinal muscles of the tentacles ordinarily developed. Conchula with 3 rectangular, large, flat lobes, more or less pedunculate, according to the state of contraction. Longitudinal pennons very strong with very numerous, high and palisade-like, sparsely ramificated folds. Parietal muscles on the pennon-side strong with numerous, comparatively high folds, only slightly ramificated or not at all so; on the opposite side weak, consisting of few, rather high folds, not expanded upon the column. Oral and marginal stomata present.

Colour: Column yellowish-brown with scattered brown spots. Tentacles brownish-yellow with brownish-red annuli. Conchula shining like mother of pearl (Danielssen and Koren).

Dimensions: Length of the body 2,5 cm, that of the tentacles 1 cm. Length of the conchula 0,9 cm (Koren & Danielssen). On the preserved type-specimen the length of the tentacles was only 0,3 cm.

Occurrence: Norway, Hardanger fiord 80—100 fms. (Koren & Danielssen). According to Grieg the type-specimen was dredged at Utne, at a depth of 376 fms.

Exterior aspect: The column is cylindrical. The only preserved specimen I have seen is furnished with longitudinal and transversal furrows, of which the latter have certainly arisen by the contraction of the animal. I have not observed any elevations of the ectoderm in form of papillae. The number of tentacles is 12. They are short, conical, sometimes a little longitudinally sulcated, probably in connection with the state of contraction, and, according to Danielssen, arranged in a single cycle. Probably there may, however, be two cycles of tentacles as in other *Peachia* species. The little oral disc is provided with indistinct radial furrows. The actinopharynx is long and has numerous longitudinal furrows (Pl. 1, fig. 30). I cannot decide its length in proportion to that of the column, as the proximal part of the specimen was torn off. The siphonoglyphe is very broad and smooth with well developed aboral prolongation. The conchula forms three rectangular, flat lobes (Pl. 1, fig. 30) which are longer than they are broad, and in the apex pressed a little in. On the figures of Danielssen and Koren (Fauna littoralis Norvegiae) it looks as if the conchula, in extended state, would be pedunculate; in the preserved specimen the conchula has no such appearance, but the basal part of each specimen is built as in other threelobed *Peachia*-species.


Textfig. 135. *Peachia boekii.* Compare the text.

Anatomical description: Only the distal part of the type-specimen being left, and this piece not being well preserved, I cannot give any complete description of the anatomy of this species.

The nematocysts in the ectoderm of the column are numerous and 14—17 × (1,5)—2 μ in size, those of the tentacles are still more numerous, 19—29 μ long and 2—2,5 μ broad, so are also the spirocysts, reaching a size of 14 × 1,5—26 × 2,5 μ. The nematocysts of the actinopharynx are 24—26 μ long and about 3,5—4 μ broad. In all nematocysts the basal part to the spiral thread is visible. The nematocysts of the actinopharynx are broader in the basal end, the others of equal breadth. The siphonoglyphe is devoid of stinging capsules. The longitudinal muscles of the tentacles form rather high folds, arranged like palisades. The siphonoglyphe is furnished with ectodermal longitudinal muscles which are wanting in the other part of the actinopharynx.

The arrangement of the mesenteries is probably like that of other *Peachia*-species. As I have wished to save the specimen I cannot, however, give any exact informations concerning the arrangement of the mesenteries. The pennons recall those of other *Peachia*-species; the folds are very high and numerous, arranged like palisades and only a little ramificated (textfig. 135, transverse-section of a perfect mesentery in the lower part of the actinopharynx). The parietal muscles on the pennon-side were well developed, those on the opposite side of the pennons, on the other hand, not strong, and containing only a few folds, some of which are rather high. A small oral stoma and a large marginal one are present, at least on the stronger mesenteries. The mesogloea of the column was very thick, in proportion to that of other *Peachia*-species; this fact is possibly connected with the strong contraction of the animal.

Genus **Haloclava** Verr.

Diagnosis: Halcampoididae with a well developed, rounded aboral body-end, physa probably not perforated by apertures. Column cylindrical with 20 longitudinal streaks of ampullaceous papillae in the distal part; indistinctly divided into regions, without spirocysts and sphincter. Tentacles 20, in the apex hemispherically swollen, forming acrospheres. Inner tentacles a little shorter than outer ones. A single ventral siphonoglyphe well differentiated and provided with a well developed (always?) aboral prolongation.

Oral part of the siphonoglyphe without a conchula. 10 pairs of mesenteries (6 + 4 lateral and ventro-lateral), all perfect and fertile. Parietal muscles distinctly differentiated from the longitudinal pennons. Spirocysts in the tentacles and the oral disc absent.

This genus, proposed by Verrill for species of *Eloactis* with ampullaceous papillae on the column, while the true *Eloactis* are devoid of such, is nearly related to *Peachia* and especially to *Eloactis*. From the latter it is distinguished only through the above-mentioned character. The column of *Eloactis* has no ampullaceous papillae, but is a little otherwise differentiated (compare *Eloactis*). Attention is called to the fact that I have not found any spirocysts neither in *Haloclava* nor in *Eloactis*.

Although this genus is not represented in the Arctic and Northern seas, nor has been dredged during the Ingolf-Expedition, I have nevertheless added it here for the sake of comparison with *Eloactis*. The type-specimen was found at the Eastern coast of the United States.

Haloclava producta (Stimps.) Verr.

Actinia producta n. sp. Stimpson, 1856, p. 100.

Halcampa producta, Stimps. Verrill, 1862, p. 30, Pl. 1, figs. 10, 11, 1874, p. 330, 738. Andres, 1883, p. 318. Mc. Murrich, 1891, p. 136, Pl. 9, figs. 2, 3.

Corynactis albida n. sp. Agassiz, 1859, p. 24.

Halcampa albida Agass. Verrill, 1862, p. 29, 1863, p. 57, 1866, p. 338, Andres, 1883, p. 318, Verrill, 1899, p. 41.

Eloactis producta (Stimps.). Mc. Murrich, 1893, p. 141—142. Parker, 1900, p. 750, fig. 4. Hargitt, 1914, p. 245.

Haloclava producta (Stimps.). Verrill, 1899, p. 41, fig. 7.

Diagnosis: Typical nematocysts in the column 17—22 × 2—2,5 μ, in the acrospheres of the tentacles 48—106 × 2 μ, in the other part of the tentacles 13—17 × 2 μ, in the actinopharynx 36—46 × 3,5 μ, and in the acrospheres nematocysts with discernible basal part to the spiral thread 72—98 × 3,5—4 μ. Ectodermal longitudinal muscles in the peduncle very strong. Longitudinal pennons of the mesenteries in the reproductive region rather strong, in transverse-sections reniform, with few, about 10 very ramificated, high folds, all of about equal length. Outer lamellar part of the mesenteries attached close by the outmost end of the pennons. Parietal muscles rather strong, with somewhat numerous, low but ramificated folds, extended in radial direction (small but high), not expanded upon the column. Marginal stomata present.

Colour: Column transparent, yellowish-green (Stimpson). Column whitish, shading off into pale salmon, the base translucent with a bluish tint. Tentacles with brownish, knob-like tips (Hargitt); var. *albida:* Column pale brownish-yellow, tentacles paler, the knobs at the tips dark brown (Verrill).

Dimensions in expansion: length 8 or 10 inches; in contraction: about 3 inches, diameter 0,75 inch. (Verrill). The largest preserved specimen, dissected by myself, was 2,5 cm long, largest diameter of the body 0,85 cm, smallest diameter 0,45 cm, length of the tentacles 0,3 cm.

Occurrence: Eastern coast of the United States from South Carolina to Cape Cod (Verrill), Fort Johnson S. C. Sandy mud, near low-water mark (Stimpson) Woods Hole. — Buzzards bay, Catama bay and in other places about Martha's Vineyard (Hargitt) var. *albida*. Long Island Sound, shores of Nantucket, Martha's Vineyard, Cape Cod. — The specimens examined by myself are from Woods Hole (Mc. Murrich) and from Newport (U. S. F. C.)

Exterior aspect: The proximal part is smooth, and according to the state of contraction, rounded physa-shaped or more flat. Whether it is perforated or not, I cannot with certainty decide as the physa was rather contracted. In sections through a part of the physa I have not found any apertures. The column is cylindrical, elongated and provided with 20 distinct longitudinal furrows, corresponding to the insertions of the mesenteries. The distal part of the column has 20 longitudinal rows of ampullaceous papillae, each row placed exactly between two insertions of the mesenteries. The rows are not all of the same length. On the parts of the column, adjacent to the 4 lateral endocoels of the first order and the ventral directive endocoel they are longer than the rows, issuing from the dorsal directive compartment, the endocoels of the second order and the 2 exocoels being next to the dorsal directive endocoel. The remaining exocoel-rows are the shorter and composed of the lesser number of papillae. This arrangement is not always distinct, at any rate the rows belonging to the exocoel-parts of the column seem to be shorter than the other rows. The papillae are larger in the distal part than in the more proximal part; in other words, the papillae originate at the distal part, continuing towards the proximal part.

The tentacles are 20, short, cylindrical, in the apex hemispherical, in certain states of contraction the distal end is knob-shaped. The 10 inner tentacles are a little shorter than the outer ones, and proceed from the endocoels (compare Carlgren, 1904, p. 542). The oral disc is of comparatively small diameter. The entrance to the siphonoglyphe is very distinct, though by far not so deep as in *Peachia;* its aboral prolongation is rather long. The actinopharynx is short with numerous longitudinal folds and furrows.

Anatomical description: Mc. Murrich (1892) has described some anatomical details of this species, but an anatomical examination of all organs has not yet been undertaken.

The three layers of the column are all of about the same thickness and of ordinary height. The ectoderm contains numerous typical nematocysts, $17-22 \times 2-2{,}5\ \mu$ in size, and numerous mucus- and albumen-cells. In the ampullaceous papillae, which are only evaginations from the body-wall, the ectoderm is a little differentiated from the other parts of the column (textfig. 136, longitudinal section through a piece of the column with a papilla). The mucus-cells namely decrease in number towards the apex of the papillae, while the nematocysts increase a little.

The main-part of the ectoderm in the apex of the papillae consists of supporting cells. The somewhat more numerous nematocysts in the apex indicate that we have to do with weak batteries of nematocysts. The mesogloea of the column is of a fibrillary structure and contains numerous cell-nuclei. The cavity of the papillae is rather large and in connection with the coelenteron through a narrower canal. In the papillae and in the communicating canal the circular muscles are very weak and form no folds, in the other parts of the column the circular muscles have high folds, which are, however, but slightly ramificated. No differentiated sphincter present.

The acrospheres in the apex of the tentacles (fig. 137 uppermost part) differ considerably in structure from the other part of the tentacles, the stalk or peduncle, in as much as the ectoderm is of quite another character, the muscle-layers almost all waning, and the mesogloea and the endoderm attenuated. The ectoderm of the acrospheres is very high, in comparison with the thin mesogloea and the endoderm. It contains large nematocysts, most densely packed, arranged like palisades, of equal width and of variable size, from 48 to 106 × 2 μ, occupying almost the whole height of the ectoderm. Besides these, there are a little broader nematocysts with visible basal part to the spiral thread, 72—98 × 3,5—4 μ in size. The ectodermal and the endodermal muscles are absent or represented by very few muscle-fibrillae. The stalk of the tentacles is of another structure (fig. 137 lower part). The ectoderm is thinner than in the acrospheres and of about the

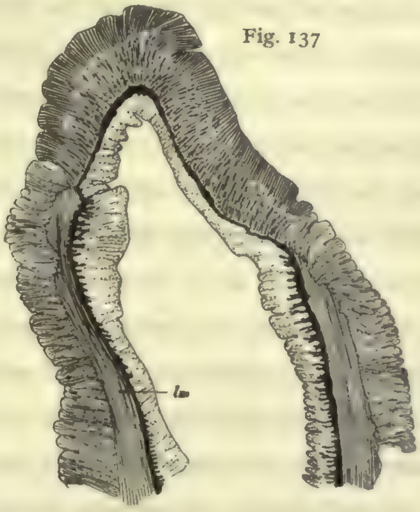


Fig. 137

Fig. 139

Fig. 136

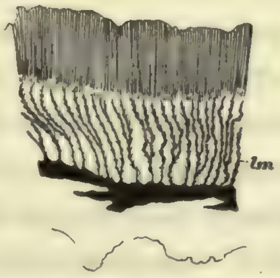


Fig. 138

Textfigs. 136—139.
Haloclava producta.
Fig. 136: Longitudinal section through part of the column with papilla. Fig. 137: Longitudinal section of the distal part of tentacles with acrosphere. Fig. 138: Transverse section through part of a tentacle. Fig. 139: Transverse section of a mesentery in the reproductive region. *lm:* longitudinal muscles; *cm:* circular muscles.

same thickness as the mesogloea, the folds of the mesogloea included. It contains gland-cells and numerous, but small nematocysts, 13—17 × 2 μ in size. The ectodermal longitudinal muscle-layer is very strong with densely packed, high folds (textfig. 137 *lm*; textfig. 138, transverse-section through a piece of the basis of a tentacle), which are sometimes not ramificated, sometimes near the basis bifid or trifid. The main lamella of the mesogloea is thin, fibrillary with rather few cells. The endoderm is of about the same thickness as the ectoderm, the endodermal circular muscles somewhat strong, through the folds are rather large.

The ectoderm of the oral disc and of the tentacles is devoid of spirocysts, the nematocysts are somewhat sparse and of the same size as in the stalk of the tentacles. In maceration-preparations I also found nematocysts resembling those of the actinopharynx. As the specimens were very much contracted in the region of the oral disc, it is, however, possible that these nematocysts in reality belong to the actinopharynx. The radial muscles were considerably weaker than the longitudinal muscles of the tentacles. The ectoderm of the actinopharynx is much higher than the endoderm, and several times thicker than the mesogloea. It contains numerous mucus- and gland-cells, and nematocysts, 34—46 × 3,6 μ in size. The longitudinal muscles are very weak and here and there absent? The ectoderm and especially the endoderm of the siphonoglyphe are thickened, the gland-cells and the nematocysts of the ectoderm very sparse, the longitudinal muscles very weak. The nerve-layer of the actinopharynx is rather distinct.

The mesenteries are 20[1] in number, namely 6 pairs of the first order and 4 pairs of the second, the latter placed in the lateral and ventrolateral primary exocoels as in *Peachia* and *Eloactis*. The four couples of the first order arising after the "*Edwardsia*-stage", viz. the fifth and sixth couples, are weaker than the outer couples of the first cycle. All mesenteries are perfect, those of the first cycle coalesced with the actinopharynx in its whole length, the mesenteries of the second cycle are inserted upon one half of the actinopharynx. The ventral directive mesenteries are the stronger, the mesenteries of the second order the weaker. The longitudinal muscle-pennons are kidney-shaped in transverse-sections through the reproductive region and well limited from the parietal muscle, in contradistinction to what occurs in *Peachia*. The folds of the muscles are high but few, about 10, richly ramificated even from the basis (textfig. 139 transverse-section through a mesentery in the reproductive region) and all of about equal height. The figures of the mesenteries reproduced by Mc. Murrich (1892, figs. 2, 3) are of a young specimen. The lamellar part of the mesenteries issues near the outside of the pennons. The parietal muscles are well developed with low, but numerous and ramificated folds spread over a comparatively large area of the mesenteries, whereby the folds become narrow and high. The parietal muscles are not expanded upon the body-wall. The mesenterial filaments are of the usual appearance; the ciliated streaks are narrow, the intermediate streaks provided with extraordinarily numerous gland-cells. The mesogloea of the filaments contains sparse cells. Oral stomata are probably absent, but marginal stomata present. They are large and irregular, and arranged with one in each mesentery in about the middle line of the mesenteries, a little below the tentacles. The animal is dioecious. The more closely examined specimen was provided with ovaria on all mesenteries. The egg-cells show a fine-grained ectoplasma and a coarse-grained endoplasma. As in *Peachia* and certain other Actiniaria the eggs are provided with a spinous covering. A "nutrition"-apparatus is developed by distinct invaginations of the endoderm extending towards the egg-cells.

Genus **Eloactis** Andr.

Diagnosis: Halcampoididae with a well developed, rounded aboral body-end, physa, perforated by numerous apertures in 20 longitudinal rows. Column cylindrical; with numerous low, not ampullaceous but solid papillae, scattered over the whole surface; not distinctly divided into regions; without spirocysts and sphincter. Cinclides in the uppermost part of the column. Tentacles as in *Haloclava*. Actinopharynx as in *Haloclava* with longer or shorter aboral prolongation. No conchula. Pairs of mesenteries as well as their muscles as in *Haloclava*. Tentacles and oral disc without spirocysts.

[1] Hargitt (1914) points out that the mesenteries are hexamerous in young specimens, decamerous in older ones, and from this he concludes that the arrangement of the mesenteries "can hardly be of great significance as a toxonomic feature". As the animal during its development passes through a hexamerous stage with 6 pairs of mesenteries of the first cycle, it is evident that this „variation" in the arrangement of the mesenteries is of no importance to the diagnosis. The adult specimens are namely decamerous.

Eloactis mazelii (Jourd.) Andr.

Pl. 1. Fig. 1.

Ilyanthus mazelii, n. sp. Jourdan, 1880, p. 41, Pl. 2, fig. 5.

Anemonactis magnifica, n. sp., Andres, 1880, p. 329.

Eloactis mazelii Jourd., Andres, 1883, p. 465, Pl. 8, figs. 4—7, fig. 39. Faurot, 1893, p. 110, Pl. 1, fig. 4, Pl. 5, figs. 1, 2. Garstang, 1892, p. 380. Walton and Rees, 1913, p. 68. Rees, 1913, p. 70, textfigs. 1—4.

Diagnosis: Nematocysts in the ectoderm of the column 26—29 × 2,5 μ, in the acrospheres 120—202 × about 4 μ, in the peduncle of the tentacles 20—24 × 2,5 μ, in the actinopharynx 53—65 × 5 μ. Longitudinal muscles of the peduncle of the tentacles strong. Pennons of the mesenteries in the reproductive region very strong with numerous (about 30) folds, high, rather much ramificated and almost all of about equal length. Outer lamellar part of the mesenteries attached to the pennon near the outside. Parietal muscles strong, provided in the outer parts with low, in the inner parts with comparatively high and a little branched folds; not expanded upon the column.

Colour: reddish-orange, physa paler, tentacles white with brown tips, oral disc orange with darker radial streaks (Jourdan) (yar. *rubra* compare Andres, 1883, p. 465). Flesh-coloured tint, tentacles marked with brown near the apex, oral disc orange-pink with somewhat paler rays (Walton and Rees). Body-wall orange, tentacles blotched with brown at the apex, several tentacles had purplish, double stripes on the inside, others appear to have only one coloured stripe (Orton). Column white, shading off into yellow. Tentacles white, shading off into flesh-colour or yellow, provided with numerous, irregular, reddish-brown spots increasing in number in the uppermost part of the peduncle, and with small opaque white spots. Oral disc of the same colour as the tentacles with 20 opaque, white tongues turning towards the mouth (specimens from Naples, Carlgren). Column shading off into brown, tentacles uncoloured (Appellöf).

Dimensions: Height of the body unto 8 cm, breadth 5 cm, length of the inner tentacles 3,5 cm, length of the outer ones 6 cm (Andres).

Occurrence: Norway. Hjälte fiord 40—50 fms (Appellöf) 1 small specimen.

Further distribution: The Mediterranean. Gulf of Marseilles 60—80 m (Jourdan). Naples (Andres).

England. Devonshire coast (Garstang). South Devon Coast, Eddystone (Walton and Rees).

Exterior aspect: The proximal body-end is rounded, forming a physa which is, however, not distinctly limited from the other part of the column. The physa is perforated by numerous, radially arranged apertures as in *Peachia.* The rows correspond in number to the mesenteries. In a large specimen from Naples I have observed more than 10 apertures in each row. The shape of the body is cylindrical or more ovoid, according to the state of contraction, and provided with 20 distinct longitudinal furrows, corresponding to the insertions of the mesenteries. On the surface there are numerous, close, flat elevations in scattered groups and of variable size, very distinct in extended specimens, but difficult to discover in contracted ones, as the column of such specimens is very wrinkled. In the uppermost part of the column there are some few cinclides. I have observed cinclides on sections (compare below) as well as on living specimens in Naples. They are, however, irregularly placed; in some chambers I have found one or several apertures, in other chambers none. By an injection with methylen-blue the colour was squeezed through the cinclides. The tentacles are 20 in number in typical specimens, and in extended state rather long. The inner tentacles, belonging to the endocoels, are shorter than the outer ones, the exocoel-tentacles, (compare Faurot, 1895 and Carl-

Textfigs. 140—143. *Eloactis mazelii.* Fig. 140: Longitudinal section through part of the column with solid papilla. Fig. 141: Transverse section through a cinclid in the most distal part of the column. Fig. 142: Transverse section of a young specimen in the actinopharynx tract. Fig. 143: Transverse section of a mesentery in the reproductive region. *cm:* circular muscles.

Fig. 140

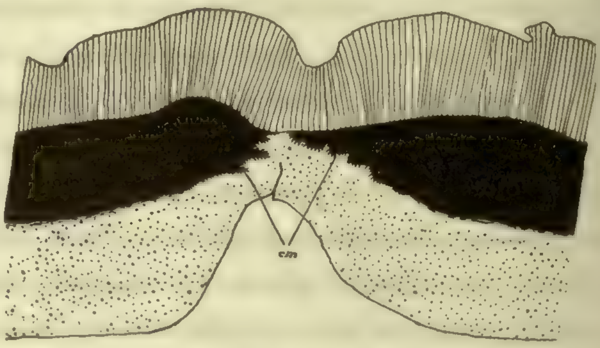


Fig. 141

Fig. 142

Fig. 143

gren, 1904, p. 542). They are cylindrical with hemispherical, smooth apices, while the main part of the tentacles, the peduncle, is provided with flat elevations like those found on the column. The oral disc is not wide, but smooth and provided with distinct radial furrows, corresponding to the insertions of the mesenteries. A well developed ventral siphonoglyphe is present. There is no conchula or tongue-shaped formation at the entrance of the siphonoglyphe. Its aboral prolongation is inconsiderable in comparison with that of *Peachia*. The other part of the actinopharynx is provided with numerous longitudinal furrows and comprises about one third of the length of the body.

Anatomical description: Rees (1913) has described the anatomy of this species; but his examination is in several points incomplete. The ectoderm of the column is high and contains numerous mucus- and sparse albumen-cells. In the central part of the elevations the mucus-cells are still sparser, while the main part of the cells is formed by supporting cells and numerous nematocysts which latter are rather sparse in the other part of the column. The nematocysts are 26—29 × 2,5 μ in size. The elevations thus may be regarded as weak batteries of nematocysts as in *Haloclava*, though they are not ampullaceous as in this genus, but compact and supported by an off-shoot of the mesogloea (textfig. 140). The cinclides and the apertures of the physa are of the same structure. The ectoderm as well as the endoderm are invaginated, and the apertures are surrounded by rather strong circular muscles belonging to the endoderm (textfig. 141). The mesogloea of the column is thicker or thinner than the ectoderm, according to the different state of contraction. It is fibrillary and contains rather numerous cells with a scanty amount of protoplasm. The endodermal circular muscles are very strong and form palisade-shaped folds, not concentrated so as to form a sphincter. Strong parts of these muscles, as usual, break through the mesenteries. The uppermost part of the tentacles, the acrospheres, are, as in *Haloclava*, of another structure than the other part of the tentacles, the peduncle. The ectoderm is very high and provided with very numerous nematocysts with slightly visible basal part to the spiral thread. They reach a size of 120—202 × about 4 μ, and are rib-like. The tentacles, as well as all other parts of the animal, are devoid of spirocysts. The nerve-layer is distinct, the ectodermal muscles very weak. The mesogloea contains rather numerous cells, poor in protoplasm, and it is about half or one third as thick as the ectoderm. In the mesogloea I have observed fibres, now straight, now folded, now running along the tentacles, now in transverse direction and terminating partly in the endoderm, partly in the ectoderm, apart from the nerve-layer. I cannot with certainty decide the nature of these fibres, but it is not very probable that they are nerve-fibrils, as they are much thicker than such fibrils; I am more inclined to think that they are nematocyst-threads having been thrown into the tissues of the animal by the ejection of the nematocysts, on account of an abnormal position of certain nematocysts. The endoderm is of about the same thickness as that of the mesogloea. The main part of the tentacles, the peduncle, is provided with a rather high ectoderm, containing numerous mucus-cells and sparse albumen-cells. The nematocysts display an indistinct basal part to the spiral thread and reach a size of 20—24 × 2,5 μ. The nerve-layer is well developed, so are also the longitudinal muscles, the folds of which in transverse-sections are dichotomously branched and of about the thickness of the ectoderm. The mesogloea is of the same structure as in the apex and attenuated towards the base. The ectoderm of the oral disc is of ordinary height and contains sparse nematocysts with indistinct basal part to the spiral thread, 17—19 × 2 μ in size. Their ectodermal muscles recall those of the peduncle of the tentacles. The mesogloea and the endoderm are thin. The ectoderm of the actinopharynx is very high and provided with numerous, rib-like nematocysts, 53—65 × 5 μ in size, and long, close albumen-cells. Their mucus-cells are sparse. The ectoderm is much higher in the ridges than in the furrows. The ectoderm of the siphonoglyphe is also very high, provided with smaller albumen-cells, but devoid of nematocysts. There is no such strongly ciliated boundary streak to be found here as in *Peachia* (compare p. 102). The nerve-layer is rather distinct in the actinopharynx. There are also very weak ectodermal longitudinal muscles. The mesogloea and the endoderm are thin in the actinopharynx, in the siphonoglyphe however thick.

There are 10 pairs of mesenteries, two of which are directives; the ventral pair is connected with the siphonoglyphe; all mesenteries are perfect and fertile. The longitudinal pennons (fig. 143) are very strong and in the reproductive region provided with about 30 high, dichotomously branched folds, most of which are of about equal height; the inner and the outer parts of the pennons are almost equally developed. The parietal muscles (fig. 143) are well differentiated, in their inner part either transversally expanded or in the lower part of the reproductive region more thin but longer. The outer part of the parietal muscles is weak and not expanded upon the body-wall. The part of the parietal muscles corresponding to the parieto-basilar muscles is sharply indicated, and a deep fold separates it from the mesogloeal main lamella of the mesenteries. Sometimes the mesogloea of both sides of this fold is coalesced, so as to form meshes in transverse-sections, a structure recalling that of the parieto-basilar muscles of for instance *Stomphia*. The ciliated streaks are also found on the ventral directives what is not the case in *Peachia*. The median streak of the filaments are provided with numerous, small, rib-like nematocysts, about 14—17 × 2 μ in size; large nematocysts are very sparse. In the cnido-glandular tract, on the other hand, large nematocysts are more common; they are partly 58—67 × 6 μ, partly 68—79 × 4 μ in size. Besides these, there are small nematocysts as in the median streak. The intermediate streak is well differentiated and provided with numerous gland-cells. The mesogloea of the filaments contains sparse cells. There is a very large marginal stoma in each mesentery. The oral stoma is rather large. The specimen is dioecious.

Description of a young specimen: The specimen, dredged in Hjälte fiord, was not sexually ripe and differs in some points from the adult specimens. Its length was 1,5 cm, the largest breadth 0,25 cm, and the length of the tentacles about 0,2 cm. The exterior of this specimen is shown on the figure 1, Pl. 1. The physa was ampullaceous, the elevations of the column distinct, especially in the distal part. The visible tentacles were 11; as there are 12 mesenteries it is probable that one more tentacle is present, though involved; I cannot, however, decide it as I have not sectioned the distal part. The aboral prolongation of the siphonoglyphe was rather well developed.

In order to make an anatomical examination of this specimen I have cut out a piece about 0,6 cm long, encluding the lower part of the region of the actinopharynx and a part below this region. The text-figure 142 shows a transverse-section through the lower part of the region of the actinopharynx. The siphonoglyphe is, seemingly, well developed, the albumen-cells are rather numerous, the endoderm of the siphonoglyphe is high, and, in contradistinction to the other endoderm of the actinopharynx, it is of a bladdery structure. The elevations of the column were not as distinctly differentiated as in the sexually mature specimens. The perfect mesenteries were 12 in number, namely 6 pairs. In a lateral exocoel one pair of weak imperfect mesenteries rose slightly over the surface of the column ectoderm. The lateral mesenteries of the second order thus arise earlier than the ventro-lateral mesenteries, in other words, the development of the mesenteries of the second order proceeds in a dorso-ventral direction, though the dorso-lateral mesenteries are suppressed. The fifth and the sixth couples of mesenteries arise as in *Halcampa*, the ventro-lateral couple thus being the weaker. None of these couples reach the undermost part of the actinopharynx. The longitudinal pennons are weaker than in the sexually ripe specimens. The folds are only slightly branched, in the lower part of the actinopharynx they are about 10 in number, below the actinopharynx a little more numerous, unto 15. The pennons vary in appearance, but their inner and outer parts look almost alike. The parietal muscles are weaker than in the adult specimens and more elongated. The ciliated streaks are not developed on the directives, but they are present on the 4 other pairs of the first order.

Genus **Siphonactinopsis** n. gen.

Diagnosis: Halcampoididae with the basal end rounded. Column cylindrical, of considerable length, smooth, without "*Halcampa*-papillae", not divisible into regions, without spirocysts and sphincter. Tentacles short, conical, 40 in number, not bulbously swollen in the apex, the inner tentacles longer than the outer ones. Only one, a ventral, siphonoglyphe, not elongated below the actinopharynx. Conchula absent. Pairs of mesenteries 20 (10 + 10) all perfect and fertile. 2 pairs of directive mesenteries. Parietal muscles a little differentiated.

Siphonactinopsis laevis n. sp.

Pl. 2. Fig. 9.

Diagnosis: Ectoderm of the column with nematocysts, about 17—20 μ long, densely packed just below the tentacles. Ectoderm of the tentacles with numerous spirocysts about 36—38 $\times$ 5 μ in size and with numerous nematocysts (22—29 $\times$ 2 μ). Longitudinal muscles of the tentacles well developed, with palisade-shaped folds. Nematocysts of the actinopharynx partly typical, 28 $\times$ 3—4 μ in size, partly broader in the basal end and with distinct basal part to the spiral thread (length 24, breadth 5 μ). Pennons of the mesenteries strong, in transverse-sections of considerable length with rather high, branched folds; as these folds are of equal height they make the pennons look like combs. Outer part of the mesenteries issues from the pennon in its most external parts. Parietal muscles not strong, consisting of low, though closely packed, a little branched folds, not expanded upon the column. Marginal stomata large. Well developed ciliated streaks.

Colour?

Dimensions: in contracted state, length 5,5 cm, breadth unto 2,5 cm, inner tentacles 1 cm long, outer tentacles about 0,5 cm.

Occurrence: Greenland? without distinct locality. (Habitat questionable!) 1 sp.

Exterior aspect: The state of preservation was rather good, wherefore I can give a fairly sufficient description of the organisation. The greater part of the ectoderm of the column was, however, lost.

The proximal part of the animal is rounded and involved. The elongated column shows no sign of being divided in regions and is devoid of papillae and other off-shoots. In consequence of the strong contraction the column is deeply transversely furrowed, while the insertions of the mesenteries on the outside are indistinctly marked. The distal end of the column is in certain places crenelated. Whether these crenelations are a normal feature or only due to the contraction I cannot decide, as this part of the animal was not well preserved. No distinct fossa is present. The tentacles are 40 in number, probably arranged in three cycles. As some of the tentacles are invaginated, it is, however, difficult with certainty to ascertain this arrangement. They are short and conical, the inner tentacles almost twice as long as the outer ones. The oral disc is rather small. There is no distinctly marked entrance to the siphonoglyphe. The actinopharynx is well developed, almost as long as half the length of the column or, at any rate, more than one third of it, and provided with numerous high folds. Only one siphonoglyphe is present at the ventral directives, it is distinguished from the other furrows in the actinopharynx by its larger breadth and shows no aboral prolongation.

Anatomical description: The proximal part of the column is — as far as I can see — of usual structure. In the very few fragments left of the ectoderm of the column I have found very sparse nematocysts, about 14—17 μ in length. Just below the tentacles and above the crenelations on the column fragments of the ectoderm were left. In these fragments I observed closely packed nematocysts and very sparse spirocysts, the latter possibly belonging to the ectoderm of the tentacles. These nematocysts were a little larger (17—20 μ long) than those of the other part of the column. Possibly we here have to do with pseudo-acrorhagi, the occurrence of which cannot, however, be added to the diagnosis, until it has been stated on better preserved material than mine. The circular muscles of the column are weak and form no sphincter. The ectoderm of the tentacles contains numerous spirocysts, 36—38 × 5 μ, and nematocysts, 22—29 × 2 μ in size. The longitudinal ectodermal muscles are well developed, with palisade-shaped folds. The oral disc is of the same structure as the tentacles, the nematocysts are, however, sparser. The ectoderm of the actinopharynx is of ordinary thickness and much thinner than the mesogloea. The granular gland-cells are very numerous, the typical nematocysts less so and about 28 × 3—4 μ in size. Besides these, there are here nematocysts with discernible basal part to the spiral thread. They are about 24 μ long and 5 μ broad in their broadest end. I have here and there found a spirocyst of the same size as that of the tentacles. The nematocysts and the gland-cells are much sparser in the siphonoglyphe than in the actinopharynx. The mesogloea of the column and of the other parts of the body is rather thick.

Textfigs. 144—145.
Siphonactinopsis laevis.
Fig. 144: Transverse section of mesentery in the reproductive tract. Fig. 145: Transverse section of the outer part of a mesentery.

Fig. 144

Fig. 145

The mesenteries are arranged in 20 pairs (10 + 10), of which 2 are directive mesenteries. All mesenteries are perfect, fertile and coalesced with the actinopharynx in its whole length. It is difficult to decide whether a pair of mesenteries belongs to an older or a younger cycle, because all pairs of mesenteries and often also both mesenteries of one pair are differently developed, as regards the muscle-pennons. The longitudinal muscles of the pennons are strong, in transverse-sections elongated with numerous (about 100) close folds, almost all of about equal height, whereby the pennons in transverse-sections get a comb-like appearance. The main lamella of the mesogloea is thickened in the outer part of the pennons, in the inner part thin. The outer, more lamellar part of the mesenteries is attached to the outside of the pennons. The inner part of the pennons is on the directive mesenteries curving towards the endocoels, on the other mesenteries towards the exocoels (textfigure 144. Transverse-section through a mesentery in the reproductive region). The parietal muscles are comparatively weak, with rather low folds, smooth or a little ramificated, especially on the side of the pennons. On the opposite side they are, however, more high and a little more richly branched (Fig. 145. Transverse-section of the outer part of a mesentery). They are not expanded on the column. No basilar muscles present. As far as I can see the oral stomata are also lacking. A large stoma, probably a marginal stoma, is visible on the mesenteries, aside from the pennons, rather near the upper end. The mesenterial filaments are very long and extended almost to the proximal end of the animal. The ciliated streaks are well developed. The mesogloea of the filaments is thick and contains few cells, poor in protoplasm. Inside the parietal muscles the mesogloea is very much thickened.

Family *Halcampidae.*

Diagnosis: Athenaria with commonly elongated, cylindrical body, with a simple or double mesogloeal sphincter, without acontia. Column divided or not divided in regions. Perfect mesenteries 8 to 12 (or more?). Ciliated streaks present, sometimes discontinuous.

Concerning the arrangement of this family, its designation and the genera, which, according to me, belong to it, compare p. 19, 21, 22.

The type of the genus *Halcampa*, after which the family is named, has, as I suggested (1893, p. 37), and as I have shown (1900 b, p. 1171), a mesogloeal sphincter, which Stephenson (1918, p. 9) has at length confirmed.

Genus **Halcampa** Gosse.

Diagnosis: Halcampidae with the column divisible into three regions, physa, scapus and capitulum. Physa ampullaceous with pores in one or two cycles. Scapus with papillae ("*Halcampa*-papillae") to which grains of sand often adhere. Ectoderm of the capitulum with numerous spirocysts, with a well developed layer of nerve-cells and nerve-fibrillae, in the uppermost part with longitudinal muscles forming a prolongation of the muscles of the tentacles and of the oral disc, and probably belonging to these muscles. Sphincter comparatively weak, often close to the ectoderm and expanding a little into the base of the tentacles. Tentacles 8 to 12, short, of equal width, with rounded apices. 2 rather slight siphonoglyphes and 2 pairs of directive mesenteries. 8—12 perfect and 6—12 fertile mesenteries forming strong pennons, besides a more or less perfect second cycle of very weak, sterile mesenteries, never producing pennons, but expanded over almost the whole length of the column.

The structure of the papillae, named by me "*Halcampa*-papillae" has never been subject to a closer anatomical examination. In English and American literature they are simply called suckers, a name also used for several heterogeneous differentiations of the column. On closer examination the papillae of *Halcampa duodecimcirrata* are found to be completely differing in structure from the verrucae of *Urticina* and other Cribrinidae. To the scapus of *Halcampa*, *Paraedwardsia* and other forms provided with "*Halcampa*-papillae", greater or smaller numbers of grains of sand most often adhere. After having loosened the grains of sand we find on closer inspection that the ectoderm of the papillae is differentiated from the other parts of the scapus ectoderm. The figure 8, Pl. 4 shows a transverse-section through a piece of the outer part of the scapus of *Halcampa duodecimcirrata* with a papilla (only the ectoderm (*ec*) and part of the mesogloea (*me*) are reproduced, the section is stained with iron-hematoxyline). The ectoderm is rather high between the papillae, but considerably attenuated towards the papillae. The outer parts of the ectoderm cells contain numerous grains. In the papillae the ectoderm is wholly transformed. Between the mesogloea and the thick cuticle we see on the section bundles of fibres (*ch*), rather strongly stained, radially arranged and separated from each other by, as it seems, fairly large intervals. The fibres connect the mesogloea, forming off-shoots with the outer, darker part, the cuticle (*c*); they are not always distinctly limited from the mesogloea. The intervals are probably only seemingly cavities, I have sometimes found several intervals to be more or less filled up by granular cells (*gl.*). I have also observed that these cells easily get loose and are torn off from their original position by sectionizing. As to the cuticle it is of a rather loose consistency, on account of its being stratified. The main part of the cuticle is strongly stained on the reproduced section, in the outer, more faintly stained part, we, however, observe that the cuticle forms several irregular lamellae, which stand out more distinctly when the cuticle is unstained. These layers are incrusted with foreign bodies (*in*).

For the sake of comparison I here reproduce two sections through the scapus of *Paraedwardsia sarsii* and *Scytophorus antarcticus*. In both species the scapus is provided with a distinct cuticle which is thicker in the papillae than in the other parts. The figure 7, Pl. 4 shows a papilla of *P. sarsii* with adjoining parts of the skin. The section much recalls that of *Halcampa*. The cavities of the ectoderm are, however, smaller, the bundles of fibres thicker. The cuticle is incrusted with foreign bodies forming a very thick layer in the papillae. The figure 6, Pl. 4 representing a transverse-section of one part of *Scytophorus antarticus* looks a little different. The cavities are large and contain cells, among others large mucus-cells (*gl.*), the bundles of fibres are shorter, and the mesogloea reaches further on towards the cuticle than in the other forms. In spite of this, there is no doubt that also here we have to do with "*Halcampa*-papillae".

How are we to explain these papillae? As far as I can see, these organs are secretory papillae, for which suggestion the circumstance also speaks that the grains of sand are not strongly attached to these papillae, while they are only with difficulty loosened from the verrucae (sucking warts) of for inst. *Urticina*. The secretion by which the grains are attached is, everything considered, formed by the granular cells enclosed in the intervals, while the fibrous bundles may be chitinized supporting cells, partly fused with the mesogloea.

Among the specimens of *Halcampa arctica* I found a specimen without incrustations. I at first suggested that this specimen did not belong to this species, but a closer examination of some sections proves that there are traces of papillae. Fig. 5, Pl. 4 represents a section through a part of the scapus, stained with carmin of borax. The ectoderm is high in the papillae and unaltered, or possibly only a little transformed. From the mesogloea off-shoots project, staining more intensely than the mesogloea itself (in the figure dark). On some folds of the ectoderm these off-shoots are transversely sectioned, in which case they show a circular arrangement. Though these papillae differ in structure from the typical papillae, I think that we also here have to do with "*Halcampa*-papillae". Unfortunately I have only a few sections which are even more than 20 years old, and it has been impossible to make new preparations as only very little of the ectoderm of the scapus remains. For these reasons I cannot with certainty judge of the structure. It is possible that the section has hit the edge of the papillae obliquely, so that the ectoderm above the papillae does not belong to these latter; this is, however, not likely. Perhaps the structure of the papillae may be interpreted thus, that the primitive papillae have been lost, so that of the chitinized ectoderm-cells, only the off-shoots, which are dark in the figure, have been left and the ectoderm has then regenerated to its full height.

Halcampa duodecimcirrata M. Sars.

Pl. 4. Fig. 8.

Edwardsia duodecimcirrata n. sp. Sars, 1851, p. 142.

— — Sars, Danielssen and Koren, 1856, p. 87. Danielssen, 1861, p. 45, Lütken, 1861, p. 196. Meyer and Möbius, 1863, p. 70, Pl. 3, figs. A-D. Andres 1880 p. 137.

Edwardsia Chrysanthellum Peach., Möbius, 1873, p. 100 (pro parte).

Halcampa — — Schulze, 1875, p. 121, 140. Haddon, 1886, p. 5, 1887, p. 478, 1889, p. 335 (pro parte).

Edwardsia lütkeni n. n. Andres, 1883, p. 308.

Halcampa farinacea Verr., Andres, 1883, p. 314 (pro parte).

— *duodecimcirrata* Sars, Carlgren, 1893, p. 38, Pl. 5, figs. 1—5, Pl. 6, figs. 1—2, textfigs. 6, 7.

Diagnosis: Physa ampullaceous, capable of almost complete involution, with small elevations, perforated by 9 (—13?) apertures, one central and the others arranged in a circle around the central one. Nematocysts of the scapus 10—12 × almost 1 μ, those of the capitulum 11—17 × 1—1,5 μ, those of the tentacles about 12 × 1 μ. Spirocysts of the capitulum 14—19 × 1,5—2 μ, those of the tentacles 14—19 × almost 1—1 μ. Tentacles 8—12. Nematocysts of the actinopharynx 27—34 × 3,5—4 μ, often narrower in the distal end and with discernible basal part to the spiral thread. Perfect mesenteries 8—12. A more or less perfect cycle of the second order present. Longitudinal pennons of the mesenteries with comparatively few folds, 8—16 or a little more, only slightly branched. Parietal muscles and the muscles of the imperfect mesenteries weak, of about the same appearance. Expansion of the parietal mucsles on the column considerable. 8 to 10 (12?) perfect mesenteries fertile.

Colour: Physa uncoloured, with small white spots. Scapus and capitulum pale flesh-coloured, the latter often pale brownish-red, especially in the distal part, and often provided with 8—12 white longitudinal stripes, terminating in a white spot below the tentacles, or with rows of spots instead of stripes. Tentacles more or less transparent, white or yellowish with 3 to 5 (6) transversal reddish-brown bands, the first band next to the oral disc M-shaped, the second V-shaped. Directive tentacles sometimes opaque white. Oral disc commonly yellowish with radial brownish-red stripes at the insertions of the mesenteries, around the mouth a brownish-red annulus, between the stripes 1—3 triangular spots. Sometimes the oral disc is opaque white without spots (Carlgren, 1893).

Dimensions: In contracted state unto 4 cm long.

Occurrence: The Baltic Sea. 6′ S. to W. off Karlskrona (Kolmodin, 1882), E. off Simbrishamn 45 fms. (Gunhild-Exp., 1878), 25° E.N.E. off Hammeren (Hammerodde) 40 fms. clay (Kolmodin, 1882), N.N.E. off Gudhjem 38—40 fms. (Kolmodin, 1882), 7′ E. to S. off Svaneke 38 fms. (Kolmodin, 1882), off Svaneke 47 fms. (Mortensen, 1895), 7′ W.N.W. off Rönne 25 fms. (Kolmodin, 1882), 55°9′ N. 13°49′ E. 25 fms., 55°7′ N. 13°31′ E. 25 fms., 54°57′ N. 13°42′ E. 25 fms. (Öberg, 1871), Kiel 7—10, 5 fms. (Meyer, Möbius, Schulze, Michaelsen). Hoh-wachterbucht 8,5 fms., W. off Ærö (Winther). The Sound (Möller, Lütken, Hering, "Sven Nilsson" St. 27, 29, 30, 38, 41, 42, 46) Kullen (Lovén), Hellebæk (Lütken, Mortensen).

The Great Belt (Winther) W. off Refsnæs 48 m (Mortensen, 1912), Königshaff Alsen (Ahlborn), The Little Belt 7—24 fms. (Schiödte).

Samsö Belt (Winther).

Cattegat (Petersen and others), Hirtsholm (Mortensen, 1897), S. off Morup reef (Gunhild-Exp., 1878), Marstrand fiord 15 fms. (1864), Gullmar fiord, Strömmarne, Skatholmen (Carlgren, 1895), between Gräsholmen and Gullholmen, N. Gåsö fiord (Wirén, Carlgren), Bohuslän (Lovén), Väderöarne (Arwidsson, 1895).

Skagerrak, $4^1/_2$ leagues S.W. $^1/_4$ W. off Skagen lightship 60 fms. (Danish biological station 1904).

Norway. Bergen (teste Sars), Drontheim fiord, Rödberg 5—10 fms. Lofoten Ure 20 fms. (teste Sars), Vadsö 20—30 fms. (teste Danielssen).

As I have before (1893) described the exterior appearance and the anatomy of this species I have not much to add now. The structure of the "*Halcampa*-papillae" has been discussed above. Concerning the relation of this species to *Halcampa arctica* compare the remarks to the latter species.

Halcampa arctica Carlgr.

Pl. 1. Figs. 3,4. — Pl. 2. Figs. 14, 15. — Pl. 4. Fig. 5.

Halcampa arctica n. sp., Carlgren, 1893, p. 45, Pl. 1, figs. 1,2. Pl. 5, figs. 6—12.

Diagnosis: Physa ampullaceous, retractile, provided with a central aperture surrounded by two cycles of apertures. Nematocysts of the scapus 12—14 × 1,5 μ, those of the capitulum 12—16 × 1—1,5 μ; those of the tentacles 12—17 × 1,5 μ. Spirocysts of the capitulum 19—32 × 2—2,5 μ, those of the tentacles (13)19 × 1—36 (41) × 2,5—3 μ. Tentacles 12. Nematocysts of the actinopharynx 24—41 × 3,5—5 μ of the same appearance as in *H. duodecimcirrata.* Perfect mesenteries 12, imperfect 12. Longitudinal pennons of the perfect mesenteries very strong, with about 20—30 larger folds in the upper part of the reproductive region. The large folds have numerous secondary folds. Parietal muscles and the imperfect mesenteries of about equal appearance, mostly comparatively strong, in transverse-sections elongated with low, but rather numerous folds. Expansion of the parietal muscles on the column considerable. All perfect mesenteries fertile.

Colour?

Dimensions: Length unto 6 cm in contracted state, breadth unto 1,2 cm. Length of the tentacles unto 0,5 cm.

Occurrence: West-Greenland, Godhavn (Andersen). Holstensborg 20 fms. (Holm 1884). Nordre Strömfiord (Nordmann). Jacobshavn 120 fms. (1870). Greenland without distinct locality.

E. of Iceland, 64°25′ N. 12°9′ W. 211 fms. Temp. at the bottom 0,8° (Ingolf-Exp., St. 58).

West Spitzbergen, Treurenberg bay 3—66 fms., Wijde bay 40 fms. (Sw. Spitzbergen-Exp. 1861), Mosel bay 3 fms. (Sw. Spitzbergen-Exp. 1862), Bel Sound 5 fms. (Sw. Spitzbergen-Exp. 1861, Malmgren, 1864), Ice fiord Safe Harbour 30 fms. (Malmgren 1864), between Coles bay and Green bay 4 m (Sw. Spitzbergen-Exp. 1908), Kobbe bay 3 fms. (1861).

East Spitzbergen, Great Island 80°15′ N. 30° E. 95 m. King Charles Land. Eastside of Jena Isl. 75 m (Römer and Schaudinn 1898, St. 37, St. 30).

Norway. Finmark (Lovén). Outer part of the Kvaenang fiord 20—30 fms. (C. Aurivillius 1881).

72°10′ N. 20°37′ E. (1868), Besimennaja bay 4—5 fms. (New Zembla-Exp. 1875), New Zembla S. of Cape Goose 3—6 fms., Cape Grebeni 8—10 fms. (New Zembla-Exp. 1875).

Kara Sea. Jugor Sound. Chabarova 5—8 fms (Vega-Exp. 1878).

It is not necessary to describe this species in detail as I have before (1893) given a summary of its anatomy. To this description I will, however, add some observations of the nematocysts, the spirocysts, and the filaments. The size of the nematocysts and spirocysts in the different parts of the body is shown on the following table. *n* nematocysts, *sp* spirocysts.

Concerning the structure of the filaments the appearance of the intermediate streaks, and probably also that of the ciliated streaks, somewhat recalls the Zoanthids. The ciliated streaks are, as we know, transversely sulcated in the Actiniaria, as well as in the Zoanthids. The ridges between the furrows are not supported by mesogloeal off-shoots, but by thickenings of the epithelium. In the Zoanthids the furrows and the ridges of the ciliated tract pass into similar furrows and ridges on the intermediate streaks, so that also these latter become transversely sulcated. The ridges of the intermediate streaks are supported by mesogloeal off-shoots, and a narrow band of the ciliated streaks covers the bottom of the furrows of the intermediate

Habitat	physa	scapus	Capitulum		tentacles		actinopharynx
	n	*n*	*n*	*sp*	*n*	*sp*	
Godhavn	—	—	—	—	about 14 × 1 μ	19 × 1—36 × 2 μ	26—36 × 3,5—4 μ
Holstensborg ...	—	—	—	—	14—17 × 1,5	19—34 × 2	26—34 × 4—5
Greenland (juv.) .	—	—	—	—	—	—34 × 2,5	29—35 × 4
—	—	—	—	—	14 × 1,5	13 × 1—30 × 2 (2,5)	(26) 31 × 4
Bel Sound	13 × 1,5 μ	13 × 1,5 μ	12—14 × 1 μ	19—29 × 2—2,5 μ	12—17 × 1,5	17 × 1—36 × 2,5	26—34 × 4
E. off Iceland ...	—	—	—	—	about 14	17 × 1—36 × 2—2,5	29—41 × 5
Nordre Strömfiord	—	—	—	—	— 14	22—41 × 2,5	24—34 × 4—5
Treurenberg Bay.	12—14	12—14	12—16 × 1	28—32	12—16	—about 28	36—40
Besimennaja Bay.	—	—	—	—	14 × 1,5	13 × 1—30 × 2—2,5	26—31 × 4

streaks. In the Actiniaria such a structure has not been observed before. Though a more extensive examination of the filaments of *Halcampa arctica* is desirable, I am, however, able to state that the filaments of this species at least indicate a structure like that of the filaments of the Zoanthids. The furrows and the ridges of the ciliated streaks also here pass into similar furrows and ridges on the intermediate streaks which are also here supported by mesogloeal off-shoots. The nuclei in the lower part of the intermediate streaks look a little different from those of the ridges. I therefore think that also here bands of the ciliated streaks are prolonged into the furrows of the intermediate streaks. Still a control examination of this feature on better material is desirable. The furrowed part of the intermediate streaks is, however, not as broad in *H. arctica* as in the Zoanthids. It almost only includes the curved part of the intermediate streaks, while at least half the intermediate streaks, adjoining the median streak, are unfolded. The figure 14, Pl. 2 shows a longitudinal section of the intermediate streaks (*is*, is_1) and of the ciliated streak (*cs*). The section has hit the filament a little obliquely. On one side (downwards in the figure) the unfolded intermediate streak (*is*) has been sectioned, on the other side the sulcated part of the intermediate streak (is_1) is seen. The figure 15, Pl. 2 also shows a similar section, a little more magnified, almost cutting through the apex of the wings of the filaments.

Remarks: The *Halcampa*-species, until now described, especially *H. duodecimcirrata*, *arctica*, *chrysanthellum*, *arenaria* and *farinacea*, are so very nearly related to each other that it is difficult to find any good species-characters. Probably there are small differences between them, but in order to judge of the constancy of these differences a closer examination is required. The nematocysts and spirocysts are of about the same size as those of the mentioned species. If Haddon's statement that only 6 mesenteries are fertile in *H. chrysanthellum*, is correct, — a renewed examination of this point is desirable — this species is well characterized. As my material of *H. arenaria* and *farinacea* is too poor — both species certainly belong to the genus *Halcampa* as the sphincter is mesogloeal — I will not now discuss these species any further. Concerning *H. arctica* and *duodecimcerrata* it is possible that we have to do with only one species having its habitation proper in the Arctic Sea, where it reaches its largest size, but also distributed at the shores of Norway and Sweden and the Eastern sides of Denmark right into the Baltic Sea, simultaneously becoming smaller and smaller in size — the numerous specimens from the vicinity of Bornholm and Scania all were very small. For the present it may be the best to retain these forms as different species. To which species Sars's short description alludes, is difficult to decide with certainty. It is possible that his *duodecimcirrata* is identical with my *arctica* as a specimen from Ure dredged by Sars and examined by myself had rather richly branched pennons. If this specimen is the type, not those from Bergen, I am almost inclined to regard *arctica* and Sars's *duodecimcirrata* as one and the same species (a closer examination of some other specimens from Lofoten is, however, to be undertaken before deciding it with certainty) If this should be found to be the case, the *Halcampa*-species from South Norway, from Sweden and from the Baltic Sea may be named *H. variabilis*. Sars has besides, at another time, evidently confounded an *Edwardsia* proper with a *H. duodecimcirrata*. In the museum of Christiania there are several now exsiccated specimens, labelled Øgsfiord, Finmark Sars, and determined probably by himself as *Edwardsia duodecimcirrata;* in reality these specimens are *Edwardsia* proper, probably *E. andresi*, like *H. duodecimcirrata* mostly provided with 12 tentacles.

Halcampa ? vegae n. sp.

Pl. 1. Fig. 2.

Diagnosis: Apertures of the retractile physa? Scapus with a thin, easily deciduous periderm. Nematocysts of the scapus, capitulum and tentacles about $13 \times 1{,}5\ \mu$. Spirocysts of the capitulum and the tentacles unto about $11\ \mu$ long. Tentacles probably 12. Perfect mesenteries 12, imperfect 12. Longitudinal pennons of the mesenteries very strong, their ramification almost like that of the pennons of *H. arctica*. Parietal muscles strong, in transverse-sections not elongated, divided into very fine and numerous branches. Imperfect mesenteries very finely folded, elongated.

Occurrence: Behring Sea 64°52′ N. 172°3′ W. 18 fms (Vega-Exp. N. 1056) 1 sp.

Exterior aspect: The exterior of the very contracted and partly not well preserved animal (Pl. 1, fig. 2) recalls that of other *Halcampa*-species. On account of the strong contraction and involution of the physa I have not been able to examine it more closely. The scapus is provided with a thin, easily deciduous periderm. Round the papillae foreign bodies are fastened. The tentacles were not well preserved, but are probably 12 in numbers.

Anatomical description: The anatomy of this species much recalls that of *H. artica*. I have indeed not been able to find the sphincter, because of the very bad preservation of the uppermost part of the capitulum and of the tentacles. I do,

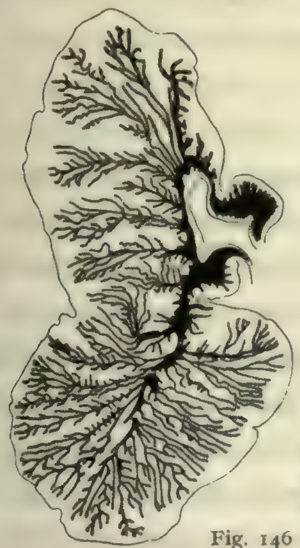


Fig. 146

Fig. 147

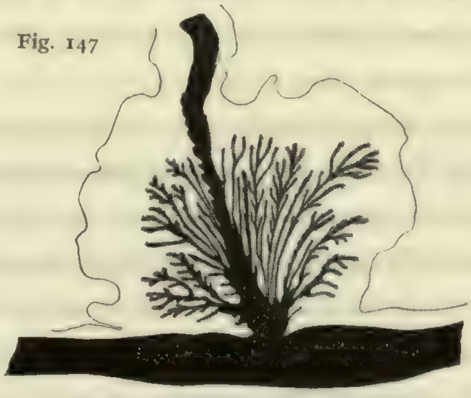


Fig. 148

Textfigs. 146—148. *Halcampa ? vegae.*
Transverse section through parts of perfect mesenteries in the reproductive region. — Fig. 146: through the pennon. — Fig. 147: through the parietal muscle. — Fig. 148: Transverse section of a mesentery of the second order.

however, think that the species is a *Halcampa* as it agrees well with other characters of this genus. The pennons of the perfect mesenteries are very much branched, as the textfigure 146 shows. The parietal muscles (textfig. 147) are more ramificated than in *H. arctica*, so are also the muscles of the imperfect mesenteries (textfig. 148). The parietal muscles are not elongated as in *H. arctica*, but more transversely spread, possibly on account of a different contraction of the muscles.

Whether this form is in reality a species different from *H. arctica* I cannot at present decide

Genus **Cactosoma** Dan.

Diagnosis: Halcampidae with the column divisible into three regions, physa, scapus and capitulum. Physa small, often flattened, not ampullaceous, probably without pores. Scapus with a cuticle and "*Halcampa*-papillae". Capitulum with comparatively sparse spirocysts. Sphincter simple, weak, expanding a little into the base of the tentacles. Tentacles short, more than 12. Actinopharynx short, without distinctly differentiated siphonoglyphes. Mesenteries arranged in two or several cycles. Only the mesenteries of the first cycle perfect, fertile and furnished with longitudinal muscle-pennons. Mesenteries of the second (and other) cycles sterile, without pennons and filaments, extended over the whole length of the column.

This genus is synonymous with *Phelliomorpha*, proposed by myself 1902 (compare below under *Cactosoma abyssorum*). As the above diagnosis clearly shows, this genus is nearly allied with *Halcampa*, and consequently it is not a transition form to the Zoanthidae, as declared by Danielssen (1900, p. 85). In addition to the type, *Cactosoma abyssorum* Dan. (= *Phellia crassa* Dan.), I refer to this genus a hitherto undescribed species from the coast of California (*Cactosoma arenaria*) and *Halianthus chilensis* Mc. Murr. Mc. Murrich (1904, p. 224) namely says about this species "The sphincter seems to have been imbedded in the mesogloea, for just below the line of insertion of the outer tentacles there was in the column-wall a narrow band of what seemed to be muscle tissue, enclosed within the mesogloea and separated by narrow bands of it from both the ectoderm and the endoderm".

Cactosoma abyssorum Dan.

Cactosoma abyssorum, n. sp. Danielssen 1890, p. 82, Pl. 6, fig. 5, Pl. 23, figs. 5—8.

Phellia crassa n. sp. Danielssen 1890, p. 60, Pl. 4, fig. 9, Pl. 13, figs. 5, 6, Pl. 14, figs. 1—5.

Isophellia crassa (Dan.) Carlgren 1900, p. 52.

Phelliomorpha crassa (Dan.) Carlgren 1902, p. 44, textfigs. 7—11.

Diagnosis: Body elongated. Typical nematocysts in the ectoderm of the scapus 10—16 × 2 (2,5) μ, in the capitulum 20—26 × 2,5 μ, in the tentacles 14—22 × 2—2,5 (3,5) μ and in the actinopharynx about 14—29 μ in length. In the ectoderm of the latter, nematocysts with discernible basal part to the spiral thread 22—33 × 4,5—5 μ in size. Spirocysts in the ectoderm of the capitulum sparse, in the tentacles very common 24 × almost 2—36 × 2,5 (1 spirocyst 43 × 4 μ). Tentacles 24 (6 + 6 + 12), the inner about one third longer than the outer. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. strong, with palisade-shaped folds. Actinopharynx longitudinally plicated. Two cycles of mesenteries. Longitudinal pennons on the perfect mesenteries strong, in the reproductive region with about 20—30 high, rather richly ramificated folds. The outer parts of the mesenteries issue not far from the outer side of the pennons. Parietal muscles elongated with close, though not high folds, they are not expanded on the body-wall, or only slightly so. Mesogloea in the region of the parietal muscles thick. Muscles in the mesenteries of the second cycle of about the same appearance as the parietal muscles of the first cycle. Well developed ciliated streaks.

Colour: Scapus brown, with dark, almost black spots. Longitudinal lines of the capitulum pale red. The rest of the capitulum pale rose-coloured. Tentacles bright salmon-red. Oral disc almost white, round the mouth a red annulus, from which 12 fine rose-coloured stripes run towards the margin of the disc (*Cactosoma abyssorum*, Danielssen). Scapus greyish-brown, capitulum almost white, outer tentacles purple, more intensely coloured at the base, inner tentacles rose-coloured. Oral disc purple, with radial violet stripes. The folded oral labiae more intensely purple (*Phellia crassa*, Danielssen). Tentacles light brown (Appellöf). The whole animal is in alcohol light brown (1 sp. from the Michael Sars-Exp.).

Dimensions: in extended state: Length of the column 4 cm, breadth 1 cm in the distal part, 0,5 cm in the proximal part; length of the tentacles 0,2 cm (Danielssen, *Cactosoma abyssorum*) — length of the column 4—5 cm, breadth in the proximal end 1—2 cm or more (Danielssen, *Phellia crassa*). In preserved state length of the column 1,3 cm, breadth 0,9 cm, inner tentacles 0,2 cm long; outer tentacles 0,1 cm (*Phellia crassa*) — length of the column 2,2 cm, breadth 0,8 cm (preserved specimen from Greenland). Length 1,8 cm. Largest breadth 1 cm. Length of the tentacles about 0,5 cm (Spec. from Michael Sars-Exp.).

Occurrence: Greenland without distinct locality (Ryder) 1 sp.

Between Spitzbergen and Finmark 74°55′ N. 16°19′ E. 400 m (Olga-Exp. St. 53, 1 sp.), 72°27′ N. 20°51′ E. 349 m. Temperature at the bottom 3,5° Sand and clay (Norw. N.-Atl.-Exp. St. 290 — *Phellia crassa*.) Off Lofoten 68°21′ N. 10°40′ E. 836 Temp. at the bottom — 0,7° (Norw. N. Atl.-Exp. St. 164, *Cactosoma abyssorum*). 62°29′ N. 4°12′ E. 518 m. Temp. at the bottom 1° (Michael Sars-Exp. 1902, St. 66), 1 sp.

Exterior aspect: The column is divided in three regions, physa, scapus and capitulum. The most proximal part, the physa, is flattened in the specimens from the Olga- and the North-Atlantic-Expeditions, in the specimens from Greenland rounded and more physa-like. There is, however, no regular pedal disc as the basilar muscles are absent, but as in many other Actiniaria the most proximal part of the body can be flattened and attached like a regular pedal disc, wherefore I supposed in my description of *Phelliomorpha crassa* (1902) that in fact a pedal disc and also basilar muscles were present. The physa is devoid of a cuticle; in the type-specimen of *Phellia crassa* it looks, however, as if it had a cuticle in some parts. The middle part of the column, the scapus, occupies the largest part of this region and is provided with a cuticle and "*Halcampa*-papillae", to which grains of sand are attached. The capitulum is short, without a cuticle and with distinct or indistinct longitudinal furrows corresponding to the insertions of the mesenteries. The tentacles are 24, in three cycles, short, the inner tentacles about one third longer than the outer ones and, according to the state of contraction, cylindrical or conical with a porus in the apex. The oral disc is flattened and small. It is true that Danielssen declares that the oral disc of *Cactosoma abyssorum* is well developed, but it seems to me that Danielssen has come to this conclusion by regarding an evaginated part of the actinopharynx as part of the oral disc. The actinopharynx is short and longitudinally sulcated. The two narrow siphonoglyphes are only little differentiated, symmetrically placed and devoid of aboral prolongations.

Anatomical description: For the anatomical examination I have used the type-specimen of *Phellia crassa* and a piece of the distal part of *Cactosoma abyssorum* (Danielssen has sectioned the lower part), I have, besides, more closely examined certain parts of the specimens from the other stations. The ectoderm of the physa is rather high and contains nematocysts of the same size as those of the scapus. The ectoderm of the scapus is a little lower and provided with a cuticle and conspicuous "*Halcampa*-papillae". It contains typical nematocysts 10—16 × 2—2,5 μ in size. The ectoderm of the capitulum is devoid of a cuticle and is higher than the ectoderm of the scapus. Its nematocysts are very numerous and much larger

Fig. 149

Fig. 150

Fig. 151

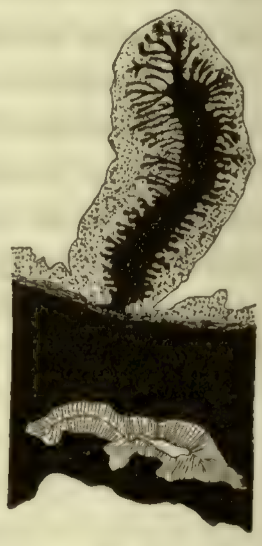


Fig. 152

Textfigs. 149—152. *Cactosoma abyssorum*. Transverse section through the sphincter (fig. 149), through a pennon (fig. 150) through a parietal muscle (fig. 151) and through an imperfect mesentery (fig. 152). The sections of the mesenteries are taken from about the middle of the column. *lm:* longitudinal muscles, *ec:* ectoderm, *en:* endoderm.

(20—26 × 2,5 μ) than those of the scapus. They are sometimes a little curved and tapering in the distal end. Between the nematocysts there are scattered spirocysts of the same size as those of the tentacles, they are, however, much sparser than in the capitulum-ectoderm of *Halcampa*. The mesogloea of the scapus is much thicker than that of the capitulum and of the physa, but also in these latter regions the mesogloea may be thickened, according to the state of contraction of these parts. The sphincter is mesogloeal, but weak and of about the same appearance as the sphincter of *Halcampa*. In position it likewise agrees with the sphincter of this genus. Also here the sphincter is drawn into the basal region of the tentacles, and the ectodermal muscles of the tentacles and of the oral disc expand over the upper part of the sphincter (compare *Halcampa!*). I have in another work (1902, p. 45) given two figures of the sphincter of a specimen of *Phellia crassa* from the Olga-Expedition, here I reproduce a transverse section (textfig. 149) of the sphincter of the type-specimen of *Cactosoma abyssorum*. These figures seemingly correspond well with each another. The strong thickening of the mesogloea on figure 8 (1902) is due to a strong contraction of the capitulum, and is of no importance. Danielssen states that the circular muscles of the column of *Cactosoma* are mesogloeal, this is, however, wrong; these muscles are, as usual, ectodermal, only the sphincter is mesogloeal, and this part has not been examined by Danielssen — the distal part of the type-specimen not having been sectionized by him. The ectoderm of the tentacles is very high and contains very numerous spirocysts of variable size, from about 24 × almost 2 to 36 × 2,5 μ and sparser nematocysts 14—22 × 2—2,5 (3,5) μ in size. The ectodermal longitudinal muscles of the tentacles are well developed, forming high folds, palisade-shaped and a little ramificated. The mesogloea and the endoderm of the tentacles are thinner than the ectoderm. The radial muscles of the oral disc are rather strong, and appear in transverse-sections as closely packed lamellae. The ectoderm of the actinopharynx is rather high and provided with numerous granular gland-cells and rather common, typical nematocysts (about 14—20 μ long); besides these, there are also nematocysts here with visible basal part to the spiral thread (22—33 × 4,5—5 μ in size). I have not examined the siphonoglyphe more closely, but it looks as if it is weakly developed. I have examined the stinging capsules in *Phellia crassa* as well as in *Cactosoma* and in the specimen from the Michael Sars-Expedition. They agree well in size; in *Phellia crassa* I have not observed any nematocysts with visible basal part to the spiral thread.

The mesenteries are arranged in two cycles and are also 24 in number, 6 pairs of perfect and fertile and 6 pairs of imperfect and sterile mesenteries. The former have pennons, the latter not. The folds of the muscle-pennons are very strong and high, especially in the tract of the actinopharynx (fig. 9, 1902); in the reproductive region they are from 20 to 30 in number, commonly of equal height and somewhat richly ramificated, particularly in the outer and the inner parts. The outer lamellar part of the mesenteries is attached to the pennon close by its outer edge (fig. 150). The parietal muscles are strong, in transverse-sections elongated, that is, much expanded radially (textfig. 151 from the type-specimen of *Cactosoma*). The mesogloea is rather strongly thickened in the tract of the parietal muscles; from the main lamella issue numerous, but not high folds which are more or less ramificated. The folds are of rather equal height, the highest folds still being situated in the innermost part of the parietal muscles. More strongly contracted parietal muscles appear more flattened. They are only a little or not at all prolonged on the column, so are also the muscles of the imperfect mesenteries, the appearance of which very much recalls the parietal muscles of the perfect mesenteries (textfig. 152 from the type specimen of *Cactosoma*).

In my report (1902, p. 45) I have supposed that *Phelliomorpha crassa* has weak basilar muscles. A closer examination proves that these muscles are nothing but the exterior part of the parietal muscles which, where the physa-region begins, are more strongly curved than the inner parts of these muscles and therefore, in transverse sections through the mesenteries in the region of the physa have been hit transversely or obliquely, while the inner part of the parietal muscles are hit more longitudinally. If transverse-sections of the Actiniaria seem to have very weak, not well marked basilar muscles, a control-examination of these muscles ought to be made on surface preparations of the mesenteries, the ectoderm having been pencilled off. On such preparations the arrangement of the muscles is namely more distinct than on single sections. The perfect mesenteries have mesenterial filaments, the imperfect mesenteries none. The ciliated streaks are of typical appearance, their mesogloea contains few cells. Danielssen declares that there are acontia in *Phellia crassa*, I have not observed any such. Only the perfect mesenteries are fertile. The species is dioecious.

Remarks: After having examined Danielssen's *Cactosoma abyssorum* I think that this species is identical with his *Phellia crassa*. In the above-named publication (1902) I placed *Phelliomorpha* (*Phellia*) *crassa* among the Paractiidae as I suggested that a regular pedal disc and basilar muscles were developed here. After having stated the incorrectness of this suggestion (compare above) the position of the genus must be among the Halcampidae. Its structure, especially that of the capitular region and of the sphincter, also agrees well with that of *Halcampa*. It might, however, not be correct to place both genera together in a single genus. The genus *Halcampa*, although furnished with 2 cycles of mesenteries, has never more than 12 tentacles, while in the genus *Cactosoma* the development of the tentacles and that of the mesenteries correspond in this way that if two cycles of mesenteries appear, the number of tentacles is also more than 12.

Fam. *Halcampactiidæ*.

Diagnosis: Athenaria without a sphincter or with a diffuse endodermal one. Acontia present.

To this family I refer the below described *Haliactis* and the genus *Halcampactis*, summarily charterized by Farquhar (1898), with its two species *mirabilis* Farq. and *dubia* Stuck. Farquhar namely states that the aboral end of *Halcampactis* is rounded and forms a physa and that there are "no sharply defined circular muscles". Stuckey (1908, p. 387), not having had an occasion to see the type, is inclined to take the genus to be a Sagartiid If Farquhar's informations are correct, the family keeps its present name Halcampactiidae; if, on the other hand, the sphincter afterwards should turn out to be mesogloeal, the genus must be placed among the Andwakiidae, provided that the basilar muscles are absent, which is likely, as Farquhar declares that the type-species has a rounded physa. If *Halcampactis* has to be removed from the family, it will be necessary to give it a new name, *Haliactiidae*. It is besides questionable if the genera *Ilyactis* and *Octophellia* proposed by Andres, do not belong to this family. If their sphincters are endodermal or no sphincter is present they probably do belong to it, if their sphincters are mesogloeal they are most likely Andwakiids.

Halcampactis is no doubt a species provided with brood-rooms. Farquhar namely says about this species "I have found full-grown individuals with numerous young ones grouped around them, evidently as they had attached themselves round the parent, when born".

Genus **Haliactis** nov. gen.

Diagnosis: Halcampactiidae with rounded proximal body-end. Column not divisible into regions, smooth, without papillae and spirocysts. No sphincter. Tentacles rather numerous, short, not swollen in the apex, the inner longer than the outer. Two weak siphonoglyphes and two pairs of directive mesenteries. Only 6 pairs of mesenteries perfect, imperfect mesenteries in several cycles. More than 6 perfect pairs fertile. Distribution of the acontia on the mesenteries?

Haliactis arctica n. sp.

Pl. 1. Fig. 31.

Diagnosis: Column elongated. Nematocysts in the column partly 13—17 × 1,5 y, partly 17—31 × 3,5—5 μ, in the tentacles 20—31 × 2 μ, in the actinopharynx partly 14—17 × 1,5 μ, partly 26—36 ×

2,5—3 μ, partly 19—38 $\times$ 3,5—5 μ. Spirocysts in the tentacles very numerous 13 $\times$ 1,5 μ to 29 $\times$ 3 μ. Longitudinal muscles of the tentacles and radial muscles of the oral disc rather well developed. Pairs of mesenteries 6 + 6 + 12; in addition to these pairs a fourth cycle in large specimens. Only the 6 first pairs with pennons, which are strong, furnished with high folds and rather richly ramificated, especially in the inner and outer parts. Parietal muscles weak, with somewhat low and sparse folds, expanded over all the outer lamellar part of the mesenteries, not sharply outlined from the other longitudinal muscles, not expanded upon the column. Muscles of the mesenteries of the second and third cycles recalling the parietal muscles of the first cycle, but with more numerous folds. Marginal stomata present. Filaments only on the mesenteries of the first order and on the distal part of the mesenteries of the second one. Ciliated streaks of usual type. Rather numerous acontia with large nematocysts. Reproductive organs on the first pairs and on the distal part of the second pairs.

Colour?

Dimensions: Largest specimen from Greenland in contracted state: Length 1,6 cm, breadth about 0,9 cm. Another specimen was 1,1 cm long and 1 cm broad, the inner tentacles 0,3, the outer 0,2 cm. Specimen from Siberia: Length 2 cm, breadth 1 cm.

Occurrence: Greenland without distinct locality, 3 sp., West-Greenland Nordre Strømfiord 375—380 m. (Nordmann, St. 2).

Bear Island (1886), 1 sp.

Spitzbergen. King Charles land 78°50′ N. 29°39′ E. 60—70 m. Clay (Sw. Spitzbergen-Exp. 1898), 1 sp.

Arctic Ocean of Siberia. 2 miles north of the winter station of the Vega (Vega-Exped.), 1 sp.

Exterior aspect: The column is much more high than it is broad and, according to the state of contraction, now more broad in the distal part, now in the middle. The proximal end is now flattened, now physa-shaped, expanded or involved. In consequence of the strong longitudinal contraction of the body the column shows numerous circular furrows. The column is smooth, without cuticle, papillae and acrorhagi, but with a broad fossa. The distal margin is distinct. The insertions of the mesenteries are clearly visible where the ectoderm is lost; probably there are longitudinal furrows, corresponding to the insertions of the mesenteries. The tentacles are most likely hexamerously arranged, in four or five cycles. The maximal number is about 96, in the reproduced large specimen (Pl. 1, fig. 31) I namely counted between 80 und 90 tentacles. Probably some tentacles may have been torn off as the preservation of the tentacles was very bad. The tentacles are conical, short, not longitudinally sulcated, and not swollen in the apex, the inner tentacles are about one third longer than the outer ones. The oral disc is probably not wide, it was not well preserved. The actinopharynx is of ordinary length and folded. The two siphonoglyphes are not very distinct and their aboral prolongations short.

Anatomical description: The ectoderm of the column, of the tentacles and of the actinopharynx is high and much thicker than the mesogloea. No cuticle is found. In the different regions of four specimens the nematocysts and the spirocysts show the following size.

Habitat	column		tentacles		actinopharynx		
	na	*nb*	*n*	*sp*	*na*	*nb*	*nc*
1. Bear Isl.	19-25 × 3,5-5 µ	15-17 × 1,5 µ	22-26 × almost 2 µ	17 × 1,5-29 × 3 µ	29-36 × 5 µ	29-36 × 3 µ	14-17 × 1,5 µ
2. Largest spec. from Greenland	19-25 × 3,5-5	?	20-24 × —	14 × 1,5-29 × 2,5-3	29-34 × 5	26-34 × 2,5	?
3. Winter-station of the Vega ..	17-23 × 3,5-5	13-14 × 1,5	22-26 × —	13 × 1,5-26 × 3	19-26 × 4-5	26-34 × 2,5	17 × 1,5
4. Greenland (Nordmann)	24-31 × 5?	14-17 × 1,5	24-31 × —	17 × 1,5-29 × 2,5-3	22 × 3,5-38 × 5	29-34 × 2,5	?

The a-nematocysts of the column were generally more thin in the distal end, in the specimens 1 and 3 sometimes a little curved and with indistinctly visible basal part to the spiral thread. In the specimen 2, the maceration preparations of which are a little unreliable in consequence of the bad state of preservation, the basal part of the spiral thread was visible, most of the capsules were destroyed here and only the rib-like basal part left. The b-capsules of the column were of equal breadth. In the a-capsules of the actinopharynx the basal part of the spiral thread was more or less visible, the a-capsules were broader in the basal end, the b- and c-capsules were in all places equally broad. The main part of the capsules in the column and the actinopharynx consists of a-capsules, the b- and c-capsules were very sparse. The nematocysts of the tentacles were rather sparse, the spirocysts numerous. The a-capsules of the actinopharynx vary a little in size, I must, however, mention that the size of the capsules in the actinopharynx is unreliable, according to the strong compression of this part; it is possible that one part of the capsules belongs to the filaments. The size of the nematocysts and the spirocysts besides agrees well in the four specimens.

Fig. 153 Fig 154.

Textfigs. 153—154. *Haliactis arctica.*
Fig. 153: Transverse section of a perfect mesentery in the reproductive tract (spec. from Greenland, »*Ilyanthus*«). Fig. 154: Transverse section of mesenteries of the second and third order and of an acontium (*ac*) (spec. from Bear Isl.).

The mesogloea of the column is not thick but very fibrillated, the endoderm is thin. The endodermal circular muscles are not strong, in the region of the fossa a little stronger, but form no differentiated sphincter (four specimens examined in this respect). The longitudinal muscles of the tentacles and the radial muscles of the oral disc are well developed.

The pairs of mesenteries are arranged in three cycles $6 + 6 + 12 = 24$. In addition to these pairs a fourth cycle is probably present in the largest specimen reproduced in fig. 31, Pl. 1. This specimen was namely provided with a greater number of tentacles than the other specimens (compare above). Only the mesenteries of the first cycle are perfect and strongly developed, the other mesenteries (fig. 154) have no pennons and their muscles recall the parietal muscles of the first cycle. The longitudinal muscle-pennons of the first 6 pairs are in the reproductive region provided with numerous high folds, ramificated in the outer and inner parts (textfig. 153). The lamellar outer part of the mesenteries is attached to the outer edge of the pennon. The parietal muscles are in transverse-sections very elongated, with rather low folds, sparse and only a little branched or not at all so, on the longitudinal muscle-side passing into the pennon, but not expanded upon the column. The parietal muscles of the specimen from Bear Island and still more of that from the Vega-Expedition are of a more robust appearance than the reproduced section of the specimen from Greenland (in the Vega-specimen the main lamella of the mesogloea is considerably more thick), probably at least partly because of a different state of contraction. They moreover greatly recall the parietal muscles of *Acthelmis intestinalis*. The mesenterial filaments are only present on the mesenteries of the first order and on the distal part of the second one. The ciliated streaks are of usual appearance. The acontia observed in sectioned specimens from all habitats are rather numerous, in transverse-sections broad and provided with very numerous nematocysts (textfig. 154 *ac*). In the specimen from Bear Island there are, as far as I can see, in the perfect mesenteries large marginal stomata near the oral disc. Concerning the reproductive organs I observed ovaria in two more closely examined specimens. They appeared only on the mesenteries of the first order and in the distal part of the second one.

Remarks: The specimens dredged off Greenland (without distinct locality) and belonging to the museum of Copenhagen were labelled *Ilyanthus*(?) *arcticus*. Lütk. They are evidently one of the two *Ilyanthus*-species which Lütken (1875) mentions from Greenland, though never describing them. They were rather badly preserved while the other specimens were in better condition. For the anatomical description I have used specimens from all habitats.

Fam. *Andwakiidae*.

Diagnosis: Athenaria with elongated, cylindrical or low, conical column. Proximal body-end forming either an ampullaceous physa or a wide flattened base, recalling a pedal disc. Sometimes with cinclides? Sphincter mesogloeal, well developed. Acontia present.

The preliminary diagnosis of this sub-family, proposed by myself 1893 (p. 38) — I then regarded it as a sub-family — differed considerably from the first diagnosis of the family, given by Danielssen (1890). In fact Danielssen's diagnosis was so extensive that it would include almost all the then described Actininae being devoid of a pedal disc. Danielssen in his diagnosis neither mentions the presence of acontia nor the occurrence of a mesogloeal sphincter, two characters of great importance to the limitation of the family. Perhaps Danielssen comes nearer to the mark when speaking of the systematic placing of the family. According to the Norwegian author the family namely forms a transition stage between the Edwardsids and the Sagartids (the Phellidae). Among the Athenaria the family is, according to me, most nearly related to the family Halcampidae with which it has several characters in common, such as the exterior habitus of the body, the occurrence of "*Halcampa*-papillae" and few perfect mesenteries, the absence of basilar muscles and the presence of a mesogloeal sphincter. With the Phellidae, on the other hand, it agrees for instance in this that acontia occur. Probably we may regard such forms as the Andwakiidae as transition stages to at least certain species described as *Phellia*, very likely not a homogeneal genus. Besides it does not seem improbable that the Sagartids including at present all Actiniaria with basilar muscles and sphincter are of polyphyletic origin, a suggestion which, however, requires closer examination in order to be confirmed[1].

To this family I think that also the genus *Octineon* Mosel, belongs. In fact this Actinia is not as remarkable as Fowler supposes and as I can confirm from my own examination of type-specimens. The basal disc and the column, both incrusted with grains of sand, have no doubt an ectoderm, though the strong incrustation makes it difficult to ascertain its true nature. It is besides difficult to get a good figure of the ectoderm because the cuticle of the scapus, viz. the incrusted part of the column, is very strongly folded. On the sections it seems as if the scapus is provided with "*Halcampa*-papillae". On the other hand, Fowler supposes that a secretion of mesogloea by wandering cells from the endoderm takes place for the adhesion of the sand—he declares, however, that he has not observed any such cells. The capitulum is short, without a cuticle and probably without spirocysts. The sphincter is very elongated, mesogloeal, with, especially in certain places, scattered meshes. The tentacles are 12, of which 6 are primary-endocoel and 6 exocoel tentacles. They are capable of invaginating like the tentacles of *Halcampoides*. Their ectodermal muscles are very weak. Like Fowler I have not observed any distinct siphonoglyphes. The number of mesenteries is in the proximal part very great, this is closely correlated with the large diameter of the basal disc. In one specimen I counted 157 mesenteries in this part, thus a much greater number than stated by Fowler. Two cycles of mesenteries in the examined specimen reach the capitular region. Of the mesenteries of the first cycle only the 8 "*Edwardsia*-mesenteries" are perfect, as far as I can see. Fowler declares that some of the weaker mesenteries are attached to the actinopharynx, and also the four couples which, together with the 8 "*Edwardsia*-mesenteries", form the 6 pairs of mesenteries of the first order. Still on Fowler's reproduction (fig. 12, Pl. 30, 1888), only the six first pairs are connected with the actinopharynx. According to Fowler the section hits the actinopharynx. It is, however, questionable whether it really is so, I am more inclined to think that the section is more distal — a mistake which may easily have occurred to Fowler as he declares that "in the histological conditions no differences are apparent between the stomadaeum and the oral disc", and the strong contraction of this part has rendered it more difficult to examine the insertions of the mesenteries. In fact the actinopharynx is easily distinguished from the oral disc, because the former is devoid of ectodermal muscles, while the latter has such. In the best preserved specimen, sectioned by myself, only the 8 "*Edwardsia*-mesenteries" certainly were perfect, and besides, no mesenteries but these reach the inner part of the oral disc. As to two other sectionized specimens I cannot determine the number of the perfect mesenteries, on account of the bad preservation and the animals being torn asunder in the region of the actinopharynx. Nevertheless it is not impossible that, in certain cases, some more mesenteries may be attached to the actinopharynx, it is namely to be observed that no reproductive organs were developed in the above-named specimen. As, however, this was one of the largest specimens and furnished with very numerous mesenteries I think that there is little reason to suppose that possibility. The 8 *Edwardsia*-mesenteries have very strong, in transverse-section perfectly circumscript, muscle-pennons, filaments and reproductive organs, the ventral mesenteries of the dorso-lateral pairs (the 5th couple), according to Fowler, has only

[1] compare p. 19.

weak pennons and is devoid of filaments and reproductive organs. The 6th couple, the ventral mesenteries of the ventro-lateral pair, is only a little stronger than the subsequent mesenteries, which are all sterile and devoid of pennons and filaments. No distinct parietal muscles are present. The parieto-basilar muscles — one half of the parietal muscles — hardly show any folds, not even on the perfect mesenteries. Basilar muscles are absent. There are ciliated streaks. I cannot, however, describe their appearance as they have been hit longitudinally. Typical acontia with close, large nematocysts are present, but I cannot decide which mesenteries have acontia. They have not been observed by Fowler. I think that the genus *Octineon* may be characterized as follows:

Andwakiidae with very wide basal disc and low conical body, much smaller in the distal part than in the proximal one. Column divisible into two regions, a proximal part, scapus, the lower part of which forms the flattened basal disc, and a short distal part, capitulum. The ectoderm of the scapus with a cuticle and "*Halcampa*-papillae" (to which grains of sand are attached). Capitulum without a cuticle and spirocysts. Sphincter mesogloeal, very elongated. Tentacles 12. No distinct siphonoglyphes. The 8 "*Edwardsia*-mesenteries" (or some more mesenteries?) perfect, fertile, with filaments and strong, perfectly circumscript, pinnate muscle-pennons. The 5th couple with weak pennons, but without filaments and reproductive organs. The 6th couple and the subsequent mesenteries like the 5th couple, but weaker and without pennons. Numerous mesenteries in the proximal part of the body. Parietal muscles not distinctly differentiated, weak parieto-basilar muscles. Ciliated streaks and acontia present.

Octineon is particularly interesting because of the transformation of its proximal body-end. Instead of forming a physa this part is flattened like a regular pedal disc (compare *Milne-edwardsia carnea* (p. 16, 63) which, under certain circumstances, can flatten its proximal part) and, in comparison with the distal part, considerably increased in size and provided with "*Halcampa*-papillae", to which grains of sand are attached. Thus the proximal body-end serves as a good anchor to the animal which is incapable of attaching in the usual way.

Genus **Andwakia** Dan.

Diagnosis: Elongated Andwakiidae with the column divisible into physa, scapus and capitulum, the first of which being only a little differentiated from the second. Scapus with "*Halcampa*-papillae". Capitulum without spirocysts. Sphincter elongated, strongly mesogloeal in the distal part reaching the basal region of the tentacles as in *Halcampa*. Tentacles more than 12. Two rather feebly developed siphonoglyphes. 6 pairs of perfect and fertile mesenteries with strong muscle-pennons. One or several cycles of sterile(?) imperfect mesenteries with weak muscles without pennons. Acontia present, but few in number. Column with cinclides (?).

The above diagnosis of the genus only slightly agrees with that given by Danielssen 1890. Also my description of the species differs considerably from that of this author. As it would be too elaborate to point out all the differences between my conception of the organisation of *Andwakia mirabilis* and that of Danielssen, I here give a mainly new description of the species which nowise deserves the name of *mirabilis*. On the contrary its organisation scarcely deviates from that of a typical Actinia, as far as I can see.

Andwakia mirabilis Dan.

Andwakia mirabilis n. sp. Danielssen, 1890, p. 86, Pl. 4, figs. 10—11, Pl. 11. Appellöf 1893, p. 12.

Diagnosis: Physa ampullaceous, probably without papillae, as for the rest like the scapus. Scapus with a cuticle and very distinct "*Halcampa*-papillae". Capitulum in contracted state with high ridges between the insertions of the mesenteries. Sphincter elongated, about twice as long as the capitulum, not stratified, not forming an offset. Tentacles about 24 in three cycles. Nematocysts in the scapus 13—17 × 2 μ, in the capitulum 17—18 × 2,5 μ, in the tentacles 19—24 u and in the actinopharynx 19—22 × 2 μ. Spirocysts of the tentacles 17 × 2—29 × 3,5 μ. 12 pairs of mesenteries. Muscle-pennons in transverse-sections through the upper part of the reproductive region with about 20 high folds which are richly ramificated and slightly recalling a circumscribed sphincter. Parietal muscles comparatively weak with few folds, not expanded upon the column. Muscles of the mesenteries of the second order recalling the parietal muscles of the mesenteries of the first cycle.

Colour according to Danielssen: The scapus brownish-black, dotted with partly white, partly green and reddish points. The capitulum faintly salmon-red, occasionally purely white with a fine rose-coloured tinge. The oral disc cinnabar-red with fine, darker lines. The tentacles of the same colour but somewhat darker at the base, lighter at the apex.

Dimensions in extended state: Length of the body 6—7 cm, breadth in the distal end 1,5 cm, in the proximal end 0,4—0,5 cm. Length of the capitulum 0,8 cm, breadth of the oral disc 1,2—1,4 cm (Danielssen). — In preserved state to about 2,5 cm long.

Occurrence: Norway. Sognefiord. Husön 100—150 fms. Sand (Norw. North-Atl.-Exp., Grieg, 1889), Hjelte fiord (Appellöf).

Exterior aspect: The proximal part of the body, the physa, is ampullaceous or flattened and, as it seems, but little differentiated from the scapus. As on the scapus the ectoderm is here furnished with a cuticle? (compare below) to which detritus-particles are fastened; it seems, however, that this cuticle is more easily thrown off than that of the scapus. Probably there are no "*Halcampa*-papillae" here. The scapus is elongated, narrow in the proximal part, more broad in the distal part, and set with numerous "*Halcampa*-papillae" to which grains of sand are attached. The capitulum is short, without a cuticle and in contracted state provided with high ridges and deep furrows, the latter corresponding to the insertions of the mesenteries. The body is in extended state cornucopia-shaped (Danielssen), in contracted state cylindrical.

The tentacles are 24, arranged in three cycles, short, conical or cylindrical, according to the state of contraction. The inner tentacles are a little thicker than the outer ones. The oral disc is not broad, the actinopharynx rather short, in preserved state with irregular longitudinal and transversal folds. Two, not very distinct siphonoglyphes are present.

Anatomical description: The ectoderm of the physa is rather high and contains somewhat numerous nematocysts of the same appearance and size as in the ectoderm of the capitulum. At the outside it is surrounded by a thin covering, imbued with detritus-particles, this is possibly a cuticle but more probably a mucus-membrane secerned by the mucus-cells. The mesogloea of the physa is much thinner than its ectoderm. The ectoderm of the scapus is thinner than that of the physa and contains nematocysts, 13—

17 μ long. The periderm is thicker than the covering of the physa and imbued with detritus, especially on the numerous papillae which seem to be of the same nature as the "*Halcampa*-papillae", though they are here supported by strong prominences of the mesogloea. The smooth ectoderm of the capitulum is high and provided with rather numerous nematocysts, 17—18 × 2,5 μ in size, sometimes a little curved, but without

Fig. 155

Fig. 156

Fig. 158

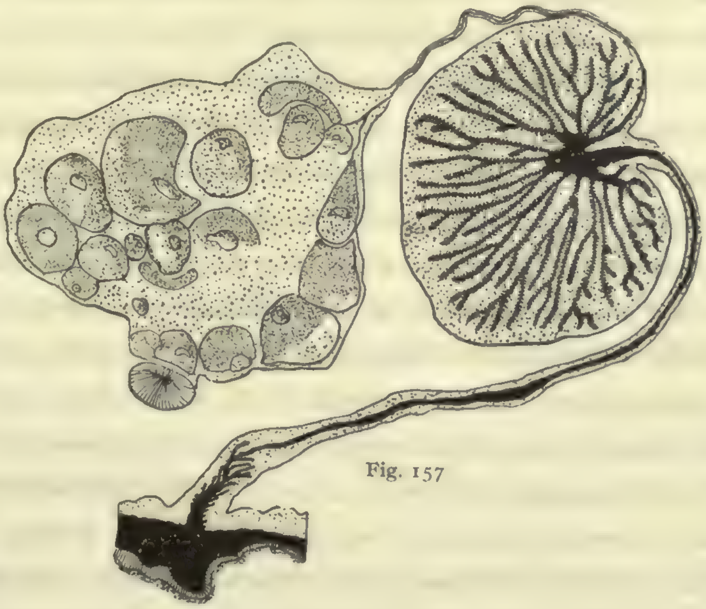


Fig. 157

Textfigs. 155—158. *Andwakia mirabilis.*
Fig. 155: Longitudinal section of the upper part of the column and of the basis of a tentacle showing the mesogloeal sphincter *t:* tentacle, *ca:* capitulum, *c:* cuticle. Fig. 156: Transverse section of a pennon in the lower part of the actinopharynx. Fig. 157: Transverse section of a perfect mesentery in the reproductive tract. Fig. 158: Transverse section of a mesentery of the second order.

spirocysts. Its mesogloea is thick, especially at the ridges. The endoderm of the column is somewhat thick, in the physa thinner than the ectoderm. The endodermal circular muscles are rather well developed and form short, palisade-shaped folds. The sphincter (textfig. 155) is mesogloeal and strong, elongated, about twice as long as the capitulum, not forming an offset, not stratified. The most distal part of the sphincter much recalls the sphincter of *Halcampa*. It is namely here divided in somewhat fine meshes and is so much elongated that the longitudinal muscles of the tentacles cover the uppermost part of the sphincter. It is besides, as in *Halcampa*, rather close to the ectoderm. In the other, larger part of the sphincter, where the mesogloea commonly is more thick, the meshes are more scattered, and larger and smaller meshes are intermingled.

The ectoderm of the tentacles is high and contains rather numerous nematocysts, 19—24 μ long, and very numerous spirocysts of variable size, from $17 \times 2\ \mu$ to $29 \times 3{,}5\ \mu$. The longitudinal muscles are ectodermal and well developed in the proximal part, here forming palisade-shaped folds, in the distal part, however, weaker. At the base the longitudinal muscles are a little stronger on the inner side than on the outer one. The endoderm is high and extended in numerous off-shoots.

The ectoderm of the oral disc contains nematocysts similar to those of the tentacles, their number is, however, considerably smaller. The radial muscles are strong and almost exclusively ectodermal, still there are sparse meshes enclosed in the mesogloea. The folds are numerous and higher than the unfolded part of the mesogloea. The ectoderm and the mesogloea are much thinner at the insertions of the mesenteries than in the intermediate parts.

The actinopharynx is folded. The ectoderm contains very numerous typical nematocysts, 19—22 $\times$ 2 μ in size, besides these also sparse nematocysts with visible basal part to the spiral thread. The latter are broader in the basal than in the distal end and 22—26 $\times$ 3,5 μ in size. The gland-cells are numerous; longitudinal muscles absent. The mesogloea is thicker than the ectoderm at the ridges, weaker in the furrows. The siphonoglyphes are narrow, their ectoderm contains less numerous nematocysts and gland-cells than the other part of the actinopharynx.

The pairs of mesenteries are 12 of which two pairs of directives. 6 pairs are perfect and 6 imperfect. The pairs of the first cycle are provided with large, longitudinal muscle-pennons which are, however, rather short and mostly developed in the distal part. The larger part of these mesenteries is devoid of pennons and the proximal part of the mesenteries therefore looks like thin lamellae. On the top of the lower part of the actinopharynx the pennon is the most developed on the outside, the folds are high and rather richly ramificated here (textfig. 156). In the reproductive region the pennon is, however, almost as much developed on the inside as on the outside. As the outer lamellar part of the mesenteries issues from the middle part of the pennon, which is thickened in the region of the actinopharynx as well as in the reproductive tract, the pennon looks rather circumscribed in transverse-sections through the reproductive region (textfig. 157). The folds amount to about 20 in number. The parietal muscles are not strong, the folds are few, low and not transversely expanded, but radially elongated (textfig. 157). They are not expanded upon the column. The muscles of the mesenteries of the second order (textfig. 158) have no pennons and are in transverse-sections of about the same appearance as the parietal muscles of the first cycle. The filaments are well developed on the mesenteries of the first cycle. Whether such filaments appear also on the mesenteries of the second cycle I cannot with certainty decide as my material was not in every respect well preserved, it seems, however, in certain cases as if also these mesenteries might be provided with very weak filaments. The ciliated streaks are of typical appearance, their mesogloea contains few cells. Acontia are present, but I cannot decide where they are attached. I have observed them in transverse-sections, they are typical and provided with large nematocysts. The reproductive organs are developed in the proximal part of the pennons of the mesenteries of the first cycle. In two examined specimens they were ovaria. I have not found any reproductive organs on the mesenteries of the second cycle, and look upon the occurrence of such organs on the mesenteries as very improbable. There are small oral stomata. Whether the large marginal stomata, observed by myself in certain mesenteries, are normal formations or not, I cannot with certainty decide. It is possible that they are artificial and due to ruptures as the specimens were strongly contracted.

Remarks: The specimens examined by myself were dredged by Grieg in their primary habitat and no doubt identical with the species of Danielssen.

Thenaria s. Basilaria.

Fam. *Actiniidae.*

Diagnosis: Basilaria with pedal disc commonly well-developed. Column smooth or provided with verrucae (sucking warts) but never with ampullaceous offshoots. Pseudoacrorhagi and acrorhagi (bourses marginales) present or absent. Sphincter absent or weak, endodermal-diffuse or diffuse-circumscribed, rarely aggregated. Tentacles cylindrical or conical, without a sphincter at their base. Mesenteries arranged in several cycles, of which generally more than one is perfect. Longitudinal muscles very rarely strongly circumscribed, mostly diffuse. Acontia absent.

Genus Actinia Brown.

Diagnosis: Body rather low. Column smooth without verrucae, its upper part capable of involution. Fossa distinct, deep. Acrorhagi, well-developed offshoots from the inner part of the fossa-wall in variable number (rarely absent.). Sphincter broad, diffuse endodermal (or meso-endodermal in *A. bermudensis* teste Mc. Murrich). Tentacles short conical. Siphonoglyphes well-developed. Mesenteries numerous, mostly perfect. Reproductive organs in the mesenteries of the first and the following orders, except as a rule in the directive and the youngest mesenteries.

Whether *A. bermudensis* really is provided with a meso-endodermal sphincter needs confirmation. Possibly the section has hit the sphincter in the vicinity of the mesenteries, where all sphincters show a tendency to be more or less mesogloeal.

Actinia equina L.

Priapus equinus n. sp. Linné, 1758 p. 656.

Actinia equina L. Linné 1766—68, p. 1088. Müller 1776, p. 230. Andres 1883, p. 393. Jourdan 1880, p. 65, Pl. 4, figs. 19—27, Pl. 5, figs. 28—40. Brunchorst 1890, p. 30. Simon 1892, p. 42. Appellöf 1900, p. 4, 1905, p. 59. Grieg, 1887, p. 12, 1898, p. 6. Pax, 1907, p. 53 (p. p.), 1908, p. 467, 1920, textfig. 1, 2.

Actinia mesembryanthemum n. sp. Ellis & Solander 1786, p. 4.

— — Ell. & Sol. Rapp 1829, p. 52, Pl. 2, fig. 1. Sars 1851, p. 144, 1853, p. 12, 1857, p. 32. Danielssen & Koren 1856, p. 87. Danielssen 1861, p. 45, Möbius 1873, p. 149. Schulze 1875, p. 139.

Priapus ruber n. sp. Forskål 1775, p. 101, p. 27, fig. a.

Actinia rubra, Forsk., Sars 1835, p. 3, 1853, p. 12.

?*Actinia cari* delle Chiaje, Arndt 1912, p. 123.

A more complete list of synonyms and literature is given by Andres 1883 and Pax 1908, p. 467. I think however that *A. rufa* of Müller is not this species but rather a young *Metridium dianthus*. *A. cari* is probably a distinct species.

Diagnosis: Nematocysts of the column 14—19 × 1,5 μ, those of the acrorhagi 41—58 (65) × 2,5—4 μ, those of the tentacles 19—24 × 1,5 μ and those of the actinopharynx 18—29 × 1,5 (2) μ. Spirocysts of the tentacles 14 × 1—29 × 2 μ. Acrorhagi spherical with an aperture, in variable number (commonly 24 teste Andres). Sphincter with low folds especially in its proximal and distal parts, the folds however rather much ramificated. Outer parts of the oral disc with tentacles in number to about 192. Inner tentacles a little longer than the outer ones. Pairs of mesenteries to about 96. Longitudinal muscles in the outer parts of the mesenteries very weak, in the inner forming rather weak diffuse pennons. Parieto-basilar muscles distinctly definite, broad, expanding over almost the whole length of the column. Basilar muscles strong. Development of the embryos in the coelenteric cavity.

Colour very variable. Pax (1907, 1920) distinguished two main forms 1) forma *rubra:* Red or scarlet-red. Acrorhagi blue. Sometimes blue annulus at the base of the column (the Bergen-specimens lack this annulus teste Appellöf), 2) forma *viridis:* Column olive grey to grass-green, acrorhagi bluish-green, annulus blue. Sars states that liver-coloured specimens (forma *hepatica* Gosse?) are common in Ögsfiord and at Hammerfest. Gosse and Andres described several varieties of colour in this species.

Dimensions: in expanded state: breadth to about 7 cm, height to 5 cm, length of the tentacles to 1,5 cm (Andres).

Occurrence. Norway: The West coast at least from Stavanger (teste Brinkman) to Hammerfest. Bergen (teste Sars, Appellöf), Sølsvig (teste Schulze and Sars), Vaagsfiord, Ulvesund, outer Nordfiord (teste Grieg), Molde (teste Arndt, *A. cari*?). Nordland—Finmark to Vadsö (teste Danielssen), Ögsfiord, Hammerfest (teste Sars).

Kola peninsula. Pala Guba (teste Pax).

Shetland Isl. Balta sound (Hammarsten, 1 sp.) (teste Norman).

?Denmark. Great Belt, Romsø (teste Möbius, probably not this species).

Further Distribution: North Sea, coast of Germany (Helgoland and other localities), Great Britain and Ireland. W. coast of Europe, W. coast of Africa to Cape Verd Isl., Madeira, Canary Isl., Mediterranean, Black Sea, Sea of Asov. — on exposed rocks from half-tide to low-water mark (Gosse).

The exterior aspect of this species has been described by several authors, likewise the anatomy especially by Jordan (1880), Simon (1892) and Pax (1920). I will here only add some notes. I have examined two species, one from the Shetland Islands (height 0,7 cm, breadth 1,5 cm) another from Naples (height 2 cm, breadth 5 cm), as regards the stinging capsules. Though the specimens were very different in size the stinging capsules were of about the same size in them both. The nematocysts of the column were very sparse, 14—19 × 1,5 μ resp. 14—16 × 1,5 μ, those of the tentacles not numerous 19—22 × 1,5 μ resp. 19—24 ×

1,5 μ, those of the actinopharynx were numerous 18—24 × 1,5 μ resp. 22—29 × 1,5 (2) μ. The nematocysts of the acrorhagi were of about equal length in both specimens 41—55 (1 nematocyst 65) μ resp. 43—58 μ, in breadth however different 2,5 μ resp. 3—4 μ. There were moreover in the first specimen broader nematocysts, to about 4 μ, but they were more irregular and probably nematocysts in development. Also sparse spirocysts are present in the ectoderm of the acrorhagi.

The acrorhagi are perforated by an aperture as already shown by Dalyell. In sectionized arorhagum of a specimen from the North Sea the aperture was aborally situated. At the aperture in the mesogloea there was an annular wall, probably formed by the endoderm. The wall, which probably forms a movable stopping, is turned outwards. Whether other apertures, cinclides, are present in the upper part of the column I cannot decide (compare Andres 1883, Simon 1892 and Pax 1908). A priori it may very well be so as the cinclides are not correlated with the acontia. Several Actiniaria namely have acontia but no cinclides, and others, as Eloactis and Harenactis, have cinclides but no acontia.

Fam. *Boloceridae*.

Diagnosis: Basilaria with a well-developed basal disc. Column without sucking warts, acrorhagi and pseudoacrorhagi. Sphincter from rather well-developed to strong, endodermal diffuse or circumscribed. Tentacles at the base constricted and furnished with an endodermal sphincter, by the contraction of which the tentacles are thrown off.

This family is proposed by Mc. Murrich (1893) for the genus *Bolocera*. At the same time he suggested that the *Liponema* of R. Hertwig was synonymous with this genus. Haddon (1898, p. 429) was of the same opinion and this was further confirmed by myself (1899, p. 40), as I found some tentacles in the type-specimen. Haddon moreover thinks that *Polystomidium* is very closely allied to *Bolocera*, and I myself gave as my opinion 1899 that both genera are identical and that the presence of acrorhagi and the occurrence of openings in the actinopharynx are the only characters through which *Polystomidium* is distinguished from *Bolocera*. The presence of acrorhagi was doubted by Haddon (1898), and their absence was stated by myself 1899, when I had examined the type-specimen. To my mind the openings are of little importance, because they probably are artificial products. As for me, I think that *Bolocera* and *Polystomidium* are synonymous.

Later (1899) I proposed for *Bolocera mc. murrichi* Kwietn. a new genus *Boloceroides* which was removed to the family Gonactiniidae, though I pointed out (1900) that the genus does not at all agree with the typical Gonactiniidae. With the placing of *Boloceroides* among the Gonactiniidae Pax (1914, p. 608 and Poche (1914, p. 97) agree, and *Stephenson* (1918a, p. 20) declares that it may be doubted, if the genus belongs to the Boloceridae, though he thinks that its "position needs reconsideration." In a paper which I am going to publish I will show that the family Aliciidae is heterogeneous — an opinion which I expressed already 1898 and 1900 — I put *Boloceroides* together with *Bunodeopsis*, *Alicia* and *Thaumactis* in the family Aliciidae, while *Phymactis*, *Rivetia* (= ?*Phymactis*), *Cystiactis*, *Phlyctenactis* (= *Cystiactis*) and *Eucladactis* (probably = *Phymactis*) are removed to a new family Cystiactiidae and *Phyllodiscus* to the Lebruniidae (Dendromelidae).

A new Bolocerid genus, *Boloceropsis*, was established 1904 by Mc. Murrich. Concerning this genus

I have before given utterance to my doubt of its place among the Boloceridae. True enough, the tentacles are constricted at the base and the mesogloea of the tentacles thicker than that of the oral disc, whereby a narrowing is formed at the base of the tentacles, but there is no tentacular sphincter. On account of this it is very improbable that the tentacles are able to loosen themselves. For the present I hold it suitable to place the genus among the Actiniidae. Pax (1914, p. 610) and Poche (1914) share my opinion, while Stephenson (1918, a, b) comes to the same conclusion as Mc. Murrich.

Stephenson (1918a, p. 20) supposes, that also *Polyopis* is a Bolocerid. In consequence of the reasons I have before given (p. 81, 82) I must place this genus to the Athenaria.

At last Stephenson (1918 b, p. 112) proposes a new genus, *Leipsiceras*, for such *Bolocera* forms which have "an extremely long and peculiar circumscribed sphincter." In this I fully agree with him. I have found a new species of this genus from Gote Islands having a still stronger sphincter than that of the type, *L. pollens*. To this family thus only *Bolocera* and *Leipsiceras* to my mind belong.

From the species, enumerated by Stephenson (1918 b, p. 112), the following must be removed.

1) *Bolocera brevicornis* Mc. Murr. which, according to Mc. Murrich (1904, p. 255), is a *Boloceroides.*
2) *Bolocera africana* Pax which is a Sagartiid (Carlgren, 1911, p. 21).
3) *Bolocera norwegica* Pax. Nothing in the imperfect description indicates that the species is a *Bolocera* (Carlgren 1911, p. 21).

Genus Bolocera.

Diagnosis: Column smooth, sometimes (always?) with scattered irregular gland-spots, not or only a little capable of involution, with a distinct fossa. Sphincter endodermal diffuse. Tentacles in contracted state longitudinally sulcated, generally very numerous, short or of considerable length, hexamerously arranged. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. Two well-developed siphonoglyphes with distinct gonidial tubercles and aboral prolongations. Muscle pennons of the mesenteries rather well-developed, parieto-basilar muscles rather weak, basilar muscles distinct. More than 6 pairs of perfect mesenteries. Distribution of the reproductive organs on the mesenteries variable.

Bolocera tuediae (Johnst.) Gosse.

Actinia tuediae n. sp., Johnston 1832, p. 163, fig. 52.

Anthea — (Johnst.), Johnston 1847, p. 242, fig. 53. Sars 1846, p. 29. Düben & Koren 1847, p. 267. Danielssen & Koren 1856, p. 87.

Anemonia — (—), *Milne-Edwards* 1857—60, p. 235.

Bolocera — (—), Gosse 1860, p. 186, Pl. 5, fig. 1. Verrill 1873, p. 5, 1883, p. 59. Schulze 1875, p. 140. Andres 1883, p. 421. Levinsen 1893, p. 396. Appellöf 1894—95, p. 11, 1905, p. 67, 71. Grieg 1897, p. 6, 7, 9, 11, 13, 1913, p. 144. Parker 1900, p. 753. Carlgren in Nordgaard 1905, p. 159. Walton 1908, p. 215. Pax 1909, p. 342, 343. Stephenson, 1918 b, Pl. 14, fig. 2, Pl. 20, figs. 1, 3—6.

Bolocera longicornis n. sp., Carlgren 1891, p. 241, 1893, p. 50, Pl. 1, fig. 18, Pl. 6, figs. 3—6, Pl. 7. Walton 1908, p. 216. Stephenson 1918 b, Pl. 20, fig. 7.

Diagnosis: Body cylindrical, in expanded state considerably longer than it is broad. Sphincter diffuse, of about the same appearance as in *Bolocera multicornis*. Circular muscles in the endoderm of the column rather strong. Tentacles conical, in expanded state very long (in regenerating specimens short?), but strongly contractile, with deep longitudinal furrows, covering about half the oral disc, numerous, arranged in 5 or 6 cycles, the outer tentacles about half as long as the inner ones. Longitudinal muscles of the tentacles and radial muscles of the oral disc well-developed with close, rather high folds. Aboral prolongations of the siphonoglyphes long. All or almost all mesenteries perfect in 4 or 5 cycles. Oral and marginal stomata present. Longitudinal and basilar muscles about as in *B. multicornis*, parieto-basilar muscles half as long as the column, weak but distinct. Reproductive organs on most mesenteries except the directives and some others of the first (second) cycle? Nematocysts in the ectoderm of the column variable, partly 14—19 × 1,5 μ, partly 26—48 × about 2.5—3,5 μ, those in the apex of the tentacles in smaller specimens 60—82 × 2,5—3 μ, in larger 70—127 × 3—3,5 μ, those in the proximal part of the tentacles in smaller specimens 36—60 × 2,5—3 μ, in larger 53—72 (86) × 2,5—3 μ, those of the actinopharynx (38) 43—62 × 3—4 μ. Spirocysts in the ectoderm of the tentacles 22 × 1—2 μ to about 77 × 4—5 μ.

Colour: Column varying from pale flesh-coloured and pink to dark red. Tentacles and oral disc generally correspond in colour with the column but are of a deeper tint, on the inside often reddish brown, in which case also the oral disc is of the same colour but of a fainter shade. Gonidial tubercles and mesenteries sometimes carmine.

Dimensions: Length in expanded state unto 20 cm, in preserved state about half as long. In contracted state the diameter of the disc is almost like the length of the column. Inner tentacles about the length of the column in expanded state.

Occurrence: The Sound, Öretvisten about 40 m ("Sven Nilsson") 1 sp.

Sweden. Gullmarfiord 40—80 fms. (Carlgren and others), Väderöarne (Goës).

Skagerrak, 370 fms, 320—380 fms (Gunhild-Exp., St. 10, 5, 6), 120 fms (Petersen 1887), 244—338 m (Thor-Exp. 1904, St. 312), (Thor-Exp. 1906, St. 11), (Thor-Exp. 1911, St. 6), 15 1/2 miles N 1/2 W. of Skagen's lightship 140 m (Thor-Exp. 1904), 16 1/2 miles SW. to W. of Skagen's lightship 106 fms (Petersen), NW. to W. of Hanstholm (Pommerania-Exp., teste Schulze).

Norway, Christianiafiord Konglungen about 10 m (Christiania mus.), Dröbak (Carlgren, Christiania mus.), Hardangerfiord, Jonanes, Saetveitnes, Thorsnes, Ljonestangen, Straumastein 100—400 m (teste Grieg), Herlöfiord 150 fms (teste Appellöf), Korsnes 337 fms (teste Schulze), Vaagsfiord 120 fms (teste Grieg), Sulenfiord 430 m. Temp. at 400 m 7°22 (M. Sars exp. 1902, St. 32), Drontheimfiord (Biol. stat.), Malangen fiord 380 m, Bottom temp. 4°1, Stönesbottn 40—80 m (Nordgaard), Lyngö (Kier).

North Atlantic: 60°57′ N. 3°42′ E. 350 m. Bottom temp. 6°16 (M. Sars-Exp. 1902 St. 47), 61°3′ N. 2°13′ E., 130 m. Temp. at 125 m 6°78 (M. Sars-Exp. 1902, St. 49), 61°4′ N. 3°11′ E. 400 m Bottom temp. 6°34 (M. Sars-Exp. 1902, St. 51), 59°35′ N. 7°8′ W. 585 fms (Ingegerd & Gladan-Exp.), 5 1/2 miles S.S.E. of Bispen, Faroe Isl., 50 fms (Mortensen). S. of Iceland 49°38′ N. 11°35′ W. 923 m (M. Sars-Exp. 1910, St. 4).

West Greenland: Bredefiord 490 m (Rink-Exp. 1912, St. 49).

Davis Strait 64°54′ N. 55°10′ W. 393 fms Bottom temp. 3°8 (Ingolf-Exp. St. 27).

Davis Strait 65°14′ N. 55°42′ W. 420 fms Bottom temp. 3°5 (Ingolf-Exp., St. 28).

Further distribution: North Sea. Coast of Great Britain and Ireland (teste Gosse, Stephenson and others), Shetland Isl. (teste Norman), Atlantic coast of North-America, Nova Scotia 50—100 fms, Gulf of Maine 50—150 fms, Casco bay 40—90 fms, Massachusetts bay 40—52 fms, Cape Cod 37—90 fms, George's bank 306 fms, Martha's Vineyard 160—640 fms, Southern New England, Cape Fear 464 fms (teste Verrill).

In my paper (1893) I have left the question open, if *Bolocera tuediae* and *B. longicornis* are identical or not. It seems to me from the above list of synonyms that we have to do with a single species, though the figures reproduced by Johnston and Gosse of *B. tuediae*, apparently the species with very strongly contracted tentacles, do not agree with the common appearance of *B. longicornis* in contracted state (compare Carlgren 1893). The tentacles of *B. longicornis* namely are capable of varying extraordinarily in length, owing to their strong longitudinal muscles. In recently dredged, sound specimens the extended tentacles are very long — the tentacles of the specimens living in the aqvarium of the biological station of Drontheim are of the same appearance — while half dead specimens have very short tentacles but often strongly swollen at the base (about as the figure reproduced by Gosse). Thus I think that the difference in length of the tentacles in *B. tuediae* and *longicornis* is due to a different state of contraction.

Another difference in the exterior of both species consists in the presence of columnar warts in *B. tuediae*, which are not observed in *B. longicornis*. Gosse not having seen the species alive namely says (1860, p. 186) that *B. tuediae* "is studded, somewhat sparsely, with minute rounded warts, which are scarcely apparent, when the animal is extended, but, on contraction, "resemble the heads of small pins in a pincushion "(W. P. Cocks)." The figure Pl. 5 in the work of Gosse representing *B. tuediae*, also shows scattered warts on the column. That they are not real sucking warts is evident (compare also Stephenson, 1918b, p. 113), it still remains to be explained of which kind the warts drawn by Cocks are. For that reason I have examined the extended column of the specimen of *B. longicornis* from Ireland on stained surface preparations, as well as on sections. It then became clear that the ectoderm of the column is not homogeneous. Over the surface there are namely scattered irregular spots containing numerous gland-cells and nematocysts, which are very sparse in the intermediate parts of the ectoderm. Probably it is these spots (possibly the intermediate parts) which Cocks has observed and which ought to appear more distinct when the column has such a colour as on Cocks' figure, but which disappear when the column is pale flesh-coloured. I therefore think that there is no difference in the structure of the column of *B. tuediae* and *longicornis*. As also the nematocysts of the two species show a good conformity it seems to me that we have every reason to conjoin the two species.

Another view is expressed by Walton (compare Stephenson 1918 b, p. 113), who has seen both species alive and who declares that they are quite "distinct." Also Stephenson (1918 b) believed himself to have found some little difference between the two forms — perhaps partly owing to his having compared "*Bolocera longicornis*" from the Falkland Islands with *B. tuediae*. He thus pointed out that *B. tuediae* has a tendency to produce "humps of mesogloea at different points in its course." I have also observed such in a specimen of *longicornis* from Bohuslän. I cannot find any real differences between the two species, though I have examined the structure of the tentacles and the sphincter and the size of the stinging capsules in specimens from very different localities, also from North-America.

The following table shows the size of the nematocysts and spirocysts in different parts of the body. The nematocysts in the apex of the tentacles are considerably longer than in the proximal part of the tentacles, the smaller specimens have shorter tentacular nematocysts than the larger specimens.

Habitat	column		tentacles: apex.		tentacles: proximal part		actinopharynx	Dimensions of the column in cm
	n	n	n	sp.	n	sp.	n	
ngolf St. 27	14—17 × 1,5 μ	29—36 × 2,5—3 μ	(60)65—77 × 3 μ	22 × 1,5—58 × 3,5 μ	43—60 × 3 μ	26 × 1,5—53 × 5 μ	46—60 × 3,5 μ	l: 1,5 b: 2,5
— » 28	...	...	60—79 × 2,5—3	24 × 1,5—58 × 3—3,5	36—50 × 2,5—3	24 × 1,5—50 × 5	...	(only small tentacles)
Lyngö (Kier)	...	...	60—73 × 2,5—3	...	...	...	38—50 × 3—3,5	l: 2,2 b: 1,5
Skagerrak	...	...	60—74 × 2—5,3	...	43—55 × 2,5—3	...	...	l: 2 b: 1,5
Bredefiord (»Rink«)	...	...	72—82 × 2,5	...	...	...	46—58 × 3—3,5	l: 2 b: 2,5
»M. Sars« 1902 St. 51	...	...	60—77 × 3—3,5	...	...	...	48—58 × 3,5	l: 2 b: 3
Bergen	...	...	(72)82—113 × 2,5—3	24 × 1 —62 × 3,5	58—73 × 2,5	24 × 1—62 × 4,5	46—58 × 3,5	l: 2 b: 3,2
Skagerrak	14—18 × 1,5	26—31 × 2,5	72—96 × 3	22 × 1,5—67 × 2,5	53—62 × 2,5	24 × 1,5—67 × 4,5	48—(84 ?)	l: 3,3 b: 3,3
Maine U. S. A.	17—19 × 1,5	37—41 × 3—3,5	87—112 × 3—3,5	29 × 2 —77 × 3-(3,5)	65—72 × 3—3,5	29 × 2—77 × 5	50—62 × 2.5—3	l: 3,5 b: 5
Off Bispen (Mortensen)	15—17 × 1,5	28—37 × 2,5—3	70—109 × 2,5-3,5	...	53—74(96) × 3—3,5	...	43—58 × 3,5—4	l: 4 b: 6,5
Bergen (Grieg)	17—19 × 1,5	29—46 × 2,5—3	77—106 × 3,5	24 × 1,5—74 × 3	62—77 × 3—3,5	29 × 2—77 × 5	46—60 × 3,5—4	l: 4 b: 7
Off Martha's Vineyard	...	...	79—103 × 2,5-3,5	...	58—72(82) × 2,5—3	...	...	...
— (U. St. F. com.)	...	...	84—106 × 2,5-3,5	...	58—72 × 2,5—3	...	...	...
North-America Verr.	...	...	96—127 × 3,5	...	70—86 × 3—3,5	...	...	...
Bohuslan	18—24 × 1,5	34—41 × 2,5	72—127 × 3,5	26 × 2—65 × 2,5	(53)60—72 × 3	29 × 2—77 × 4—5	53—62 × 3—3.5	l: 8 b: 9,5
—	...	...	98—118 × 3,5	...	...	...	...	large spec.
S.o.Iceland »M.Sars« St. 24	15 × 1,5	38—48 × 3	96—106 × 3,5	...	...	...	53—60 × 3,5—4	l: 10 b: 8,5

The anatomy of this species was described by myself (1891, 1893) as to *B. longicornis*, and by Stephenson 1918 b as to *B. tuediae*. I have not placed *B. longicornis* from the Falkland Islands (Stephenson 1918 a, p. 20) in the list of literature, as I am not fully convinced that this species is identical with *B. tuediae* (*longicornis*), though it may possibly be so.

Bolocera multicornis Verr.

Bolocera multicornis n. sp. Verrill 1879, p. 198. Andres 1883, p. 453.

— — Verr., Mc Murrich 1893, p. 155. Haddon 1898, p. 430. Parker 1900, p. 351. Carlgren 1902, Pl. 3, figs. 1, 2, textfig. 1, 2.

Sagartia (*Phellia*) *abyssicola*, Koren and Dan. (p. p.). Danielssen 1890, p. 30, Pl. 10, fig. 4.

Diagnosis: Column low with distal part considerably broader than proximal part. Sphincter diffuse without tendency to become somewhat circumscript, with close, high folds. Circular endodermal muscles of the column comparatively strong. Tentacles extraordinarily numerous, closely packed together, covering the greater part of the oral disc, short, longitudinally sulcated, conical to cylindrical and in the latter case rounded in the apex, all of about equal length. Well-developed aboral prolongations of the siphonoglyphes. Mesenteries of large specimens extraordinarily numerous. Perfect mesenteries, in comparison to the number of mesenteries, probably few. Oral stomata present; marginal stomata? Pennons of the mesenteries broad with palisade-shaped folds. Basilar muscles well-developed, fan-like expanded. Nematocysts in the ectoderm of the column, tentacles, and actinopharynx very numerous, those of the column 19—24 (28) × 1,5—2 μ, those of the tentacles 30—60 × (2) 2,5 μ in the apex and (19) 22—36 × 2—3 μ in the proximal part, and those of the actinopharynx 31—47 (52) × 2,5—3,5 μ. Spirocysts in the extoderm of the tentacles numerous, from 22 × 1,5 μ to 55 (60) × about 5 μ.

Colour of the column and tentacles nearly uniform, bright redlead-coloured or orange-scarlet, mouthfolds a deeper shade of the same colour (Verrill). The tentacles of the Ingolf-specimens are dark reddish-brown in the distal parts.

Dimensions in preserved state: Oral disc unto 16 cm, length of the column unto 6 cm, breadth of the basal disc unto 9 cm, length of the tentacles to about 4,5 cm.

Occurrence: Davis Strait: 65°34′ N. 54°31′ W. 68 fms. Bottom temp. 0,2 (Ingolf-Exp., St. 29), 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3,9° (Ingolf-Exp., St. 32), 68°20′ N. 54°03′ W. 228—280 fms. (Tjalfe-Exp. 1908).

In the neighbourhood of Bear Island 74°25′ N. 17°36′ E. 180 m (Olga-Exp., St. 49). Between Bear Island and Spitzbergen 75°40′ N. 17°10′ E. 190—200 m (Olga-Exp., St. 55), 75°31′ N. 17°50′ E. 225 m. Bottom temp. 1°6 (Norw. North.-Atl.-Exp., St. 326). 61°15′ N. 9°35′ W. 872 m (Thor-Exp., 1904, St. 99).

Behring Island, 75 fms. (Vega-Exp.).

Further distribution: North-America. Cape Cod 45 fms. (U. S. Fish Com.) 47°40′ N. 47°35′30″ W. 206 fms. (U. S. Fish Com.) (teste Verrill).

A description of this species was given by myself 1902. The following table shows the size in μ of the nematocysts and the spirocysts in some specimens.

Habitat	column	tentacles: apex.		tentacles: proximal		actinopharynx
	n	*n*	*sp.*	*n*	*sp.*	
Behring Isl.	19—24 × 1,5—2	38—60 × 2,5	29 × 1,5—55 × 4(5)	24—31(39) × 2,5(3)	26 × 2 × 43 × 5(6)	37—47 × 3—3,5
Davis Str. (Ingolf) ..	19—24 × 1,5	34—50 × 2,5	22 × 1,5—45 × 2,5	19—36 × 2-2,5	24 × 1,5—43 × 5	31—41 × 2,5—3,5
— (Tjalfe).	—	30—53 × 2—2,5	—	24—31 × 2-2,5	—	—
Olga Exp.	24—28	52—60	—	—	—	40—52

The size of the stinging capsules in the specimen from the Olga-Expedition is only approximate.

In addition to these species tentacles of a *Bolocera* species were taken during the Ingolf-Fxpedition at the stations 37 and 38 (60°17′ N. 54°05′ W. 1715 fms. Bottom temp. 1°4, 59°12′ N. 51°05′ W. 1870 fms. Bottom temp. 1°4). The nematocysts were considerably longer here than in very large specimens of *B. tuediae.*

In the apex of the tentacles the nematocysts show a size of 96—192 × 3,5—4,5 μ, in the proximal part 68—120×3,5—4 μ. Probably we have to do with a new species which provisionally may be named *B. maxima*.

Fam. *Cribrinidae s. Bunodactiidae.*

Diagnosis. Basilaria with well developed pedal disc. Column sometimes smooth, sometimes with sucking warts or ampullaceous papillae. Acrorhagi (bourses marginales) or pseudo-acrorhagi sometimes present. Sphincter strong, endodermal circumscribed. Tentacles short or of ordinary length, rarely with transversal swellings on their oral surface (*Ixalactis*). Mesenteries arranged after the number of 6, 8 or 10. Perfect mesenteries usually numerous. Acontia always absent.

The genera belonging to this family must undergo a renewed revision. It is true that Mc. Murrich (1901) has made an attempt to give a more distinct definition of the genera of this family, but his attempt seems too provisional to me. Besides, the genera cannot be definitely limited until the family has been examined more particularly as to its anatomy. In his publication (1901) Mc. Murrich comprises 12 genera, 3 of which with an interrogation mark. Of these latter *Tealiopsis* must be completely excluded as, according to my examination, it is synonymous with *Stomphia* and therefore not belonging to this family. On the systematic place of *Thelactis*[1] and *Physactis* we cannot as yet set forth any opinion, as they have not been anatomically examined. The genus *Gyractis*[2] is not identical with *Cribrina*, as Mc. Murrich thinks possible, but very likely with *Anthopleura*, and the genus *Leiotealia* must perhaps be dropped, based as it is on the presence of a smooth column, a character which it has in common with the older *Epiactis* of Verrill, as well as with *Isotealia* and partly with *Urticina*. It is, however, possible that it can be retained, but in that case the diagnosis of the genus must be altered and perhaps partly be founded on the appearance of the longitudinal muscles of the mesenteries which seem to differ from those in *Epiactis*. So far the genus must be regarded as dubious. The genus *Isotealia* is certainly a distinct genus and not synonymous with *Leiotealia*, as Hertwig does not mention the presence of any perforated pseudo-acrorhagi in the latter genus (among others). *Pseudophellia* is not identical with *Tealiopsis* which latter does not belong to this family (compare above!), but, as far as I understand, with *Epiactis*. True enough, the column of *Pseudophellia arctica*, "the type of the genus, is covered by an adherent cuticle" (Verrill), as, however, the column of the type of *Epiactis*, *E. prolifera*, which I have had the occasion to examine, is limited towards the outside by a cuticle, though a very thin one, and as it seems easily deciduous, there exists between the cuticle of *Pseudo-*

[1] *Thelactis* is probably a *Bunodeopsis* and not belonging to the family.

[2] Unfortunately a control examination of the specimens, determined by Boveri as *Gyractis*, does not seem to be possible. I have not been able to distinguish with certainty in the Munich Museum the specimens examined by Boveri. In the collection of Dr. Ondaatje there are, however, a number of specimens externally exactly resembling Boveri's *Gyractis* — part of these specimens had been sectioned, probably by Boveri. These latter as well as the whole collection were badly preserved and the ectoderm almost in all places lost. On several specimens I could, however, find a great number of closely packed, large nematocysts in glycerine preparations of the region of the acrorhagi. This indicates that there are true acrorhagi. As besides the sphincter was circumscribed the specimens must belong to the genus *Anthopleura*. As also Boveri mentions acrorhagi ("Randbläschen") in *Gyractis*, there is no doubt that *Gyractis* is synonymous with *Anthopleura*. The absence of directive mesenteries and siphonoglyphes in *Gyractis* possibly might serve to justify the establishment of a special genus; I do, however, think that it is unnecessary, above all because I am not fully convinced that Boveri's observations concerning the mesenteries are correct. Some of the above named *Gyractis*-shaped specimens, examined by myself, were furnished with 2 pairs of directive mesenteries. As Boveri's examination of the mesenteries seems to be somewhat superficial, it will be advisable to accept with caution his statement of the absence of directive mesenteries and siphonoglyphes in the genus *Gyractis*.

phellia and that of *Epiactis* only a difference in degree, in as much as the cuticle is stronger in the former species, weaker in the latter. As *Epiactis* and *Pseudophellia* agree in other characters too, *Pseudophellia*, which is synonymous with the older *Epiactis*, may be dropped, and the type of *Pseudophellia* be called *Epiactis arctica*. *Cribrina*, *Urticina* and *Ixalactis* are, to my mind, rather well defined genera. Whether *Epigonactis* is synonymous with *Urticina* or not is, however, very dubious and cannot be decided until the genus has been subject to a careful anatomical examination — I have before (1901 p. 483) placed this genus together with *Epiactis*, and Stephenson (1918 a p. 27) was of my opinion. Finally I do not think that *Anthopleura* and *Bunodosoma*, which Mc. Murrich has placed together to a single genus, are identical. As far as I can see from Mc. Murrich's description of the verrucae of *Anthopleura xantogramma* and *A*. (*Aulactinia*) *stelloides* they are in structure like those of *Cribrina* and *Urticina* and are real suckers to which foreign bodies are attached, while the ampullaceous off-shoots in *Bunodosoma* are constructed in a different way, and, according to my examination, more in accordance with the prominence of the column of *Phymactis* and *Cystiactis*. Thus the ampullaceous off-shoots of the column of *Bunodosoma* are not suckers, but rather to be considered as weak batteries of nematocysts to which no foreign bodies are attached. Mc. Murrich (1889 p. 24) himself has emphasized this difference, but later on (1901) not made use of it for systematic purposes, in which he was mistaken, as far as I can understand.

The characters which distinguish the genera of this family from each other are first of all based on the presence of acrorhagi, further, on the occurrence or non-occurrence of real suckers and ampullaceous batteries of nematocysts on the column, on the exterior of the tentacles and the arrangement of their longitudinal muscles and of the radial muscles of the oral disc, on the distribution of the reproductive organs in the mesenteries and on the arrangement of the latter. The importance of these characters to the classification however wants further discussion.

The absence or presence of acrorhagi is no doubt a good character, as no variation occurs within the genera in this respect, but these characters are either present or absent in the respective genera. On the other hand, the systematic importance of other differentiations of the column is partly totally different. It is true that the ampullaceous papillae are characteristic of *Bunodosoma* and always present here (as in *Anthopleura* this genus is characterised through the presence of acrorhagi), but the appearance of suckers is evidently subject to variation, in as much as the same genus and the same species now have suckers, now are devoid of such. This is the case with *Urticina*. It is also possible that the below described, new genus *Cribrinopsis*, which is typically furnished with suckers, sometimes is devoid of them. The absence of discernible suckers in strongly contracted and badly preserved specimens should not, however, absolutely be interpreted as if suckers were in reality lacking, the suckers of such specimens not being easily discernible to the naked eye, not even under high magnifying powers. Thus it is only with great caution that we may use the presence or absence of sucking warts as a systematic character, as mentioned before by Mc. Murrich. In the other genera, *Cribrina* and *Anthopleura*, the occurrence of verrucae seems to be constant, while the genus *Epiactis* is always devoid of verrucae.

The longitudinal muscles of the tentacles and the radial muscles of the oral disc are now mesogloeal, now ectodermal and commonly constant in the respective genera, though also here a certain variation sometimes takes place. Concerning the former they seem to be almost exclusively mesogloeal in *Cribrinopsis*; in *Urticina* they variate, as I will show below, from ectodermal to meso-ectodermal or ecto-mesogloeal, and this even in the same species. In the other genera these muscles are ectodermal or meso-ectodermal as in *Cribrina elegantissima* and *spetsbergensis*. It is exactly the same with the radial muscles, though they are never as much enclosed in the mesogloea as the longitudinal muscles of the tentacles. Commonly they are ectodermal, in the genera *Cribrina* and *Urticina* ectodermal or meso-ectodermal, in the latter case they agree with those of *Cribrinopsis*. In *Urticina* they variate from ectodermal to meso-ectodermal in the same species.

Concerning the distribution of the reproductive organs in the older mesenteries, the genera *Isotealia* and *Urticina* differ from the other genera. In *Urticina*, according to its age, only the 6 first pairs of mesenteries, or the 10 or 20 oldest mesenteries are sterile (compare below), while in *Isotealia* the reproductive organs first appear on the mesenteries of the third cycle. The other genera have reproductive organs, as far as we know, even in the mesenteries of the first order which remain fertile.

The arrangement of the mesenteries as a genus character is of more secondary significance, as it varies considerably especially in certain genera, even in species such as *Cribrina* and *Cribrinopsis*. On the other hand the mesenteries are in the other genera more typically, hexamerously arranged, while the genus *Urticina* shows decamerism. Especially concerning the latter genus the question has been raised, whether the decamerism may be used as a genus-character. Mc. Murrich (1901 p. 21) namely declares; "to establish a genus on its decamerism seems to me . . . . to place it on an exceedingly insecure foundation." He founds his statement, for one, on an information by Verrill that "many *Urticina crassicornis* are hexamerous, many others decamerous, some octamerous and a few irregularly or unequally developed on opposite sides." If that really is so, the decamerism is here certainly worthless as a genus-character. At present I, however, much doubt that Verrill's identifications of the genus have always been correct. As we will see from the following it is very difficult, without the most careful investigation, to distinguish the genus *Urticina* from another genus, *Cribrinopsis*, and young specimens of *Urticina* likewise from *Cribrina*. I for my part have almost always found *Urticina* decamerous (only a single time octamerous), though irregularities occur, so that not all mesenteries of the same cycle may be developed. There is, besides, nothing astonishing in this that the arrangement of the mesenteries in an early period of its life displays a variation, as *Urticina* during its development passes through a hexamerous stage. To my mind the decamerism may be used as a genus-character to *Urticina*, though with a certain restriction. Decamerism, octomerism and hexamerism principally may be used as genus-characters. Certain genera (and species) namely have a more constant mesenterial arrangement than other genera, wherefore the arrangement is usable here as a systematic character, while other genera show so great a variation in the grouping of their mesenteries that the mesenterial arrangement is useless for systematic purposes. Of course we must leave out of consideration accidental defects of the mesenteries causing any kind of disorder to the typical arrangement. There can, for instance, be no doubt that the arrangement of the 8 "*Edwardsia*-mesenteries" is of great systematic importance, though in the Milne-Edwardsinae only 7 mesenteries exceptionally occur (p. 64 compare a similar suppression of mesenteries in a young *Peachia* p. 105). Finally it must be proved in each special case if the decamerism, the octomerism etc. is due to regeneration, in which case it is of no systematic importance, as I have before pointed out (1914 p. 63).

The identification of the Arctic and North-American Cribrinidae has till now been rather difficult. True enough, it is easy to distinguish *Cribrina stella* from other forms, though alcoholic specimens of this species have possibly been confounded in the literature with the below described *C. spetsbergensis*, but some of the other forms, especially specimens without reproductive organs, agree so well with each other that in certain cases it is almost impossible to distinguish them, if we do not make use of the dissimilarity of the nematocysts as a means of identification. Through a systematic examination of the size of the nematocysts in a great number of specimens I have, however, been able to distinguish several Cribrinids which have certainly been more or less confounded with each other by several authors, myself not excepted. After having laid a sure foundation through a study of the size of the nematocysts I have, little by little, found other characters usable as distinctive marks to the different genera and species. The importance of a closer study of the nematocysts in order to classify the Actinians — which I have several times emphasized — stands out here in the most striking manner.

Whether any of the species, mentioned below by myself, have been described before can hardly be decided as the North-American Cribrinids are more or less imperfectly known, especially as regards their nematocysts. No satisfactory answer can be given to this question, until the nematocysts of the North-American forms have been subject to closer examination.

Genus **Cribrina** Ehr. s. **Bunodactis** Verr.

Diagnosis: Cribrinidae with a well developed pedal disc. Column with suckers (verrucae), arranged in more or less distinct lines, without true acrorhagi, sometimes with pseudo-acrorhagi. Sphincter strong. Tentacles from short to of ordinary length, simple, like the mesenteries hexamerously arranged, in certain species after another number or irregularly arranged. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal, sometimes with a tendency to be a little mesogloeal. Most often 2 distinct siphonoglyphes. Numerous perfect mesenteries. Reproductive organs on the first cycle (sometimes not developed on the directive mesenteries) and on the other stronger mesenteries.

In my paper 1899 I have put forms furnished with real acrorhagi together with *Cribrina*. That is however not right, but such species as *Bunodes hermafroditica* might be referred to *Anthopleura*. Whether such species, having pseudo-acrorhagi, belong to *Cribrina* or to *Anthopleura*, is difficult to decide. Mc. Murrich refers them to *Cribrina*, and for the present I do the same, though it would perhaps be more correct to arrange them with *Anthopleura*, as the pseudo-acrorhagi may be regarded as beginning acrorhagi.

Cribrina stella (Verr.) Mc. Murr.

?*Actinia coriacea* Stimpson 1853 p. 7.

Bunodes stella n. sp. Verrill 1864 p. 16. Pl. 1 figs. 1—8, 1868 p. 258. Andres 1883 p. 447. Parker 1900 p. 752.

Bunodactis stella (Verr.) Verrill 1899 p. 43.

Cribrina stella (Verr.) Mc. Murrich 1910 p. 76 Pl. 3 figs. 6—7.

Bunodactis spectabilis Verrill 1879 a p. 15, 1879 b p. 152.

Diagnosis: Body generally cylindrical or columnar, its height often double its diameter. Column with well-developed verrucae in the upper part. Tentacles 40—48. Sphincter of the palmate or mixed type. 2 siphonoglyphes. Mesenteries hexamerously arranged in 4 or 5 cycles, more numerous than the tentacles, the first two cycles perfect. Longitudinal muscles of the mesenteries well-developed, forming distinct, diffuse pennons. Parietobasilar and basilar muscles rather well developed. Nematocysts of the tentacles (17) 22 — 31 × 1.5 — 2.5 μ, those of the actinopharynx 24—38 × 3—4.5 μ. In the latter also nematocysts with distinct basal part to the spiral thread 24—31 × 3.5—5 μ in size. Nematocysts of the column 17—19 × 1.5 μ. Spirocysts of the tentacles from 13 × 1 μ to 31 × 2 μ.

Colour olive-green or brown, sometimes flesh-coloured. Tentacles translucent greyish or brownish with an opaque white spot at the base and a faint whitish chevron mark about half-way between the tips and the base. The disc brownish, in young individuals opaque white bands radiating towards the bases of the primary tentacles. Actinopharynx white, inside of the mouth light orange (Verrill, Mc. Murrich). Colour green (Dons).

Dimensions unto 5 cm in length in extended state (Verrill).

Occurrence: North America: New Foundland's bank 46°5′ N. 51°44′ W. 56 fms., sand, shells (Ingegerd-Gladan-Exp. 1871 J. Lindahl).

North Greenland: 25 fms. (Torell).

West Greenland: Upernivik 34 fms. (Ingegerd & Gladan-Exp. 1871), Disco fiord (The Danish Arctic station 1898), Disco bay 3—25 fms. (Holm 1886), Godhavn (Ammondsen 1872), Claushavn (Öberg 1870), Godthaab littoral (Ryder 1883), Frederikshaab (Lundbeck 1889), Nordre Strømfiord littoral (Nordmann 1911), Holstensborg (Traustedt 1892), Store Hellefiskebanke 18 fms. (Holm 1886).

East Greenland: 72°20′ N. 21°20′ W. 70 m. (Sw. Greenland-Exp. 1899), Tunok Angmagsalik 65°53′ N. (Kruuse 1902), Tasiusak 25—30 fms. (East Greenland-Exp. 1899).

Iceland: Berufiord 3 fms. littoral, Skerja fiord, littoral (A. C. Johansen 1900), Stykkisholm littoral (A. C. Johansen. 1900), Djupivogur littoral (A. C. Joh. 1900). Iceland without distinct locality.

West Spitzbergen: Smeerenberg bay 4—10 fms. (1868), Treurenberg bay 6—30 fms. (1881), Icefiord, Klas Billen bay 32—40 m (Sw. Spitzbergen-Exp. 1908), Axel Isle, Bel sound (1910).

East Spitzbergen: Lomme bay 10 fms. (Sw. Spitzbergen-Exp. 1861), Great fiord. Cap Blanck 65 m. (Römer & Schaudinn 1898 St. 5), Whales point 20—30 fms., clay (Malmgren 1864).

Norway. Finmark: Vadsö littoral (Sandeberg 1877), Porsanger fiord, littoral (Michael Sars-Exp. 1900), Nordkap (Verkrüsen 1875), Kjösen in Ulfsfiord, littoral (1861), Grötsund littoral (1861), Tromsö littoral (Kier 1902, Dons 1910, 3 m, Dons 1912), Gibostad 3 m (Dons 1912), Sorvaer (Ohlin 1890).

Kola peninsula: The Russian biological Station, Kolafiord (Derjugin 1906), Ladigano, Chewanna 30 fms. (Sandeberg 1877), Vaideguba littoral (Sandeberg 1877), Semiostrowa 50—55 fms. (Sandeberg 1877), Litsa (Sandeberg 1876), Scharetskaja (Lilljeborg 1848).

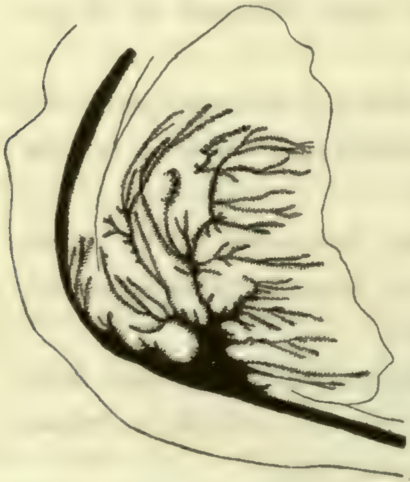
Kara Sea: Jugor Shorr off Chabarova 5—8 fms. (Vega-Exp.).

Arctic Sea of Sibiria: 20′ off Cape Jakan 12 fms. (Vega-Exp.), 2 miles north of the winter harbour of the Vega 67°4′49″ N. 173°23′2″ W. (Vega-Exp.), Behring sound 67°4′ N. 173°24′6″ W. 7—9 fms. (Vega-Exp.).

Further distribution. North America. Arctic ocean to Cape Cod (teste Parker). Cape Elisabeth Me., Eastport Me., Grand Menan N. B. in crevices of rocks near low-water mark, Cumberland Bay (teste Verrill), Passamaqvoddy Bay St. Andrews on rocks (teste Mc. Murrich). From Maine to Greenland (teste Verrill).

The anatomy of this species has been described before by Mc. Murrich (1910), wherefore I find a recapitulation unnecessary, but will add some supplementary remarks to his description.

The longitudinal muscles of the tentacles are ectodermal and resemble those of *C. spetsbergensis*, described below, the muscle folds however show no tendency here to be mesogloeal. The radial muscles of the oral disc are a little weaker and ectodermal (verified on several specimens). In 8 specimens collected from different localities, among others from Eastport, I have more closely examined the sphincter. In all specimens it was of a palmate type. In no case the secondary lamellae issue from any distinct main lamella — in a specimen from Frederikshaab there is, however, an indication of a main lamella. Now the sphincter was more broad with distinct palmate extension of the lamellae, now it was more narrow and composed of several very thin main lamellae. Mc. Murrich's figure (1910 Pl. 3 fig. 7) of the sphincter probably is not typical as it shows a pinnate appearance with a thick main lamella. In the textfigure 159 I have reproduced the sphincter of a specimen from Wales point.



Textfig. 159.
Cribrina stella.
Transverse section of sphincter.

The verrucae were commonly distinct, in some specimens (from Discofiord, Porsangerfiord and North Cape) indistinct, owing to a bad state of preservation or to a strong contraction of the column.

The number of mesenteries variates from 24 to 48 pairs, that of the tentacles in the specimens examined by myself from 40—48. The mesenteries thus are more numerous than the tentacles. The mesenteries of the last cycle are developed in the proximal part of the body and grow from here in oral direction, but do not reach the distal end of the column.

In order to show the constancy of the size of the nematocysts, I give here the following table.

Habitat	nematocysts of the tentacles	spirocysts of the tentacles	actinopharynx typical nem.	actinopharynx nem. with visible thread.	number of tentacles	number of mesenterial pairs 73
Eastport	24—29×2 μ	18×1—31×2 μ	31—36×3—3,5 μ	—	—	—
— (small spec.).	20—26×2	—31×2	(24×2)29—34×2,5—3,5	—	46	23 + 21
Discofiord	20—26×2	—	29—36×2—3,5	—	40	12 + 12
—	20—26×2	—	29—36×3—3,5	—	48	—
Frederikshaab........	17—24×2	13×1—19?×2	24—30×3—3,5	—	—	—
Nordre Strømfiord ...	22—29×2—2,5	15×1—29×2—2,5	29—36×4	—	48	—
Angmasalik..........	24—31×2—2,5	17×1—31×2	30—36×3,5—4,5	—	—	—
Berufiord............	22—29×2	—	29—36×3	—	—	—
Bell Sound	24—31×2(2,5)	17×1—31×2	30—38×3—3,5	—	—	—
Porsangerfiord	22—25×2	17×1—24×2	29—36(38)×3,5	24—31×3,5—5	—	—
Nordkap	22—26×2(2,5)	—24×2	26—31×3—3,5	—	—	—
—	22—26×(1,5)—2	—26×2	—	—	—	—
Tromsø	22—29×2	—	29—37×3	—	—	—
—	22—29×(1,5)2	—29×2	29—36×3	—	—	—
Gibostad	(19)22—26×(1,5)2	17×1—26×2	29—34(36)×3(3,5)	22—24×3,5—5	—	—
Coast of Murman	22—26×2	—	31—36×3	—	—	—
Kola. Chewanna	24—29×2—2,5	—	29—35×3—3,5	—	—	—
Winter harbour of Vega	23—29×2—2,5	—	30—37×3—3,5	—	46	24 + 24
— — —	22—26×2	—	29—37×3—3,5	—	—	—
— — —	22—29×2—2,5	—	31—36×3	—	—	the half 22

As we see, the size of the nematocysts and the spirocysts agrees well in the different specimens. The nematocysts of the column are shorter than those of the tentacles, in five more closely examined specimens 12—14 × 1,5 μ, 12—14 × 1 μ; 18—23 × 1,5—2 μ; 17—19 × 1,5 μ, 20—23 × 2 μ.

Mc. Murrich has found embryos in the coelenteric cavity in May, I myself in June, July, August and October.

Cribrina spetsbergensis (n. sp.).

Pl. 2. Fig. 2.

Rhodactinia crassicornis (O. F. M.) var. *spetsbergensis* Carlgren 1902 p. 39, textfig. 3.

?Leiotealia spetsbergensis n. sp. Kwietniewski 1898 p. 134 (pro parte).

Diagnosis: Column with commonly rather small verrucae, at least in the upper part. Sphincter palmate or pinnate. Tentacles in variable number unto 96, thick, cylindrical, in contraction smooth or more seldom longitudinally sulcated, at most as numerous as the mesenteries, all of about equal length. Longitudinal muscles of the tentacles well-developed with in general high folds, principally ectodermal, but at the base of the folds and sometimes at their apex in small parts enclosed in the mesogloea. Radial muscles of the oral disc like the longitudinal muscles of the tentacles but more enclosed in the mesogloea. Mesenteries of variable number unto 49 pairs, commonly hexamerously but often irregularly arranged, so that not all mesenteries of the last cycle are developed. Muscles of the mesenteries strong, especially the longitudinal and the parietobasilar muscles. Reproductive organs on all the stronger mesenteries, sometimes also on the directives. Nematocysts of the tentacles (24) 26—42 × 2—3 μ, those of the actinopharynx (34) 36—53×3,5—5 μ, spirocysts of the tentacles (18) 22 × 1—1,5 to 53 × 2,5 μ.

Colour?

Dimensions: Specimen from Behring Sound (Pl. 2 fig. 2) in contracted state: Height 3 cm, largest breadth about 6 cm. Length of the tentacles 0,8 cm. — Specimen from New Foundland: largest breadth 7 cm, height about 3,5 cm.

Occurrence: New Foundland (Verkrüzen 1876).

Greenland without distinct locality.

Between Iceland and Faroe islands 64°07′ N. 11°12′ W. 237 fms. Temp. at the bottom 2°,5 (Ingolf-Exp. St. 4).

76°23′ N. 15°7′ E. 145 m (Olga-Exp. St. 41). 74°55′ N. 17°30′ E. 180—135 m (Olga-Exp. St. 52).

64°53′ N. 10°0′ E. 630 m. Temp. at the bottom — 0,69° (Michael Sars-Exp. 1900 St. 10).

62°35′ N. 4°4′ W. 620—640 m. Temp. at 620 m. —0°,03 (Michael Sars-Exp. 1902 St. 67).

Norway. Finmark (Kolthoff).

Behring Sound 67° N. 173° W. 9—15 fms. (Vega-Exp.).

Exterior aspect. The exterior of the body much recalls that of *Urticina*. The pedal disc is wide and the length of the column in contracted state shorter than the diameter. On the column there are longitudinal lines of verrucae, which are probably always present in the upper part. Whether the verrucae are developed also in the most proximal part of the column I cannot decide, as the specimens were strongly contracted in this region and partly not well preserved. On most specimens the verrucae were distinct. In some specimens (from the Michael Sars-Expedition and in one specimen from New Foundland the verrucae were very indistinct or inconspicuous, and it is questionable if the species sometimes is devoid of verrucae, a question, which is very difficult to answer, as it regards strongly contracted and badly preserved material. The verrucae are commonly not as large as those of *Urticina felina coriacea*. A distinct fossa is present. The tentacles are short, cylindrical, all of about the same length, smooth or sometimes with shallow to rather deep longitudinal furrows, and a little flattened in the apex. The arrangement of the tentacles probably varies considerably in the outer cycles, as the number of the tentacles (like that of the mesenteries) is very indistinct, in the inner cycles the number of 6 may be prevalent. The smallest number of tentacles was 34, possibly 36, the greatest 96. The number of tentacles corresponds to that of the mesenteries or is a little smaller. The oral disc is wide. The two siphonoglyphes are broad and furnished with well-developed aboral prolongations. The actinopharynx is long and has longitudinal folds in great numbers.

Anatomical description: The ectoderm of the column is high and contains numerous mucus-cells. The nematocysts of the column are smaller than those of the tentacles, in the specimen from Finmark the size was 17—22 × 1,5—2 μ, in the other examined specimens from four localities the size varied from 22 to 31 × 2—2,5 μ. The verrucae are of the same appearance and structure as in *Urticina felina coriacea* (compare below!). The mesogloea is thick and fibrillary with numerous, scattered, protoplasma-poor cells. The endodermal circular muscles are well developed. The structure of the sphincter is rather variable. In the most closely examined specimens it was of a palmate type, in two specimens of a pinnate one. In the textfig. 164 I have reproduced the palmate sphincter of the specimen from the Olga-Expedition St. 41. A similar sphincter is developed in the specimen from Finmark. In the specimens from the station 4 (Ingolf-Exp.), and from Greenland, in one specimen from the station 67 (Michael Sars-Exp.) and in one individuum of *Leiotealia spetsbergensis* the sphincters are of decidedly palmate type without a distinct main lamella. A pinnate sphincter with a thin main lamella is present in the reproduced specimen from Behring's Sound textfig. 163) and in a specimen from the station 25 (Michael Sars-Exp.). As transition stages between the

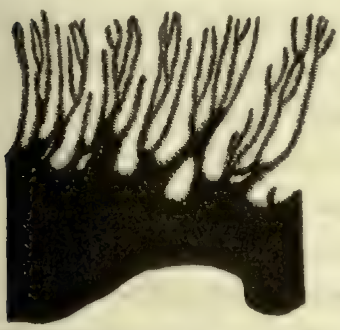


Fig. 160

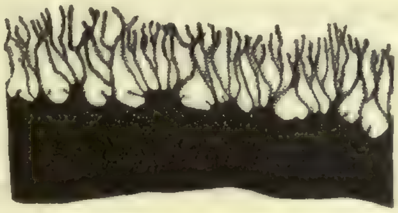


Fig. 161

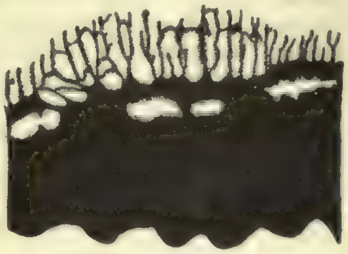


Fig. 162

Fig. 163

Textfigs. 160—164.
Cribrina spetsbergensis.
Transverse sections of tentacles (figs. 160, 161), of oral disc (fig. 162) and of sphincters (figs. 163—164). (Fig. 160 spec. from St. 52 Olga-Exp.; figs. 161, 163 spec. from Vega-Exp.; fig. 162 spec. from St. 67 M. Sars-Exp.; fig. 164 spec. from St. 41 Olga-Expedition).

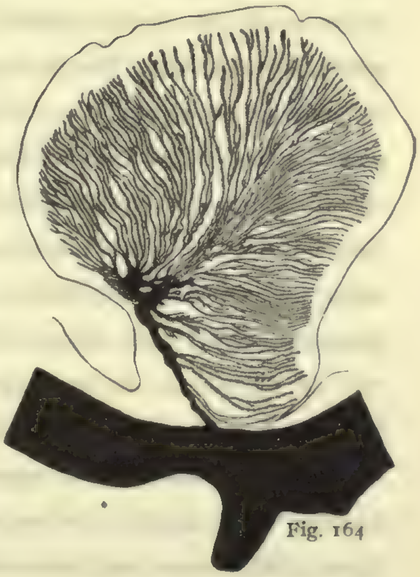


Fig. 164

pinnate and palmate type we may consider the sphincters of a specimen from the station 52 (Olga-Exp.) and of an individuum from New Foundland. In the former there is a very thick main lamella, but not so long that we may regard the sphincter as palmate, in the latter the main lamella is thin at the base, but much expanded inwards and forming a thick irregular triangle. In the sphincter, reproduced on the textfig. 163, streaks of muscle meshes are seen in some places. Such mesogloeal streaks in the sphincters indicate that parts of the mesenteries have been sectioned. All endodermal sphincters as well as the endodermal muscles in common become mesogloeal at the moment when they break through the mesenteries.

The ectoderm of the tentacles is high and contains numerous nematocysts and very numerous spirocysts. The size of the nematocysts in the tentacles and in the actinopharynx and of the spirocysts in the tentacles is seen from the following table, in which also the number of tentacles and pairs of mesenteries and the distribution of the reproductive organs on the directives are stated.

Habitat	Tentacles nematocysts	Tentacles spirocysts	Actinopharynx nematocysts	Number of tentacles	Number of mesenterial pairs	Distribution of the reproductive organs on the directives
New Foundland	31—38×2,5 μ	19×1,5—48×2 μ	36—43×4,5—5 μ	82	22 + 23	♂ d+
— —	31—36×2	—	41—50×3,5	77	19 + 21	♂
— —	29—34×2	24×1,5—53×2—2,5	41—48×3,5	96	24 + 27	
— —	26—36×2	—48×2	41—48×3,5	—	23 + 24	♂
— —	29—36×2	—43×2	36—43×3,5—4,5	88	22 + 23	
Ingolf-Exp. St. 4	24—31(34)×2	—	36—46×4—5	34 (possibly 36)	9 + 9	♂
Finmark	26—36×2—2,5	22×1,5—43×2	38—43×4,5—5	36	9 + 9	♂ d+
Greenland (small sp.) .	24—29×2	—	34—41×3—3,5	—	—	—
"Michael Sars" St. 67 .	34—41×2,5—3	24×2—53×2,5	43—53×4—5	80	20 + 20	♂
— — .	31—42×2—2,5	24×1,5—53×2—2,5	41—49×4,5—5	—	16 + 16	♀ d+
— St. 10 .	27—35×2,5	22×1,5—43×2—2,5	38—47×3,5—4,5	77	19 + 21	—
Behring's strait	29—36×2,5	22×1,5—48×2—2,5	42—48×3,5—4	the half 40	24 + 24	♀ d+
Olga-Exp. St. 52	—	—	—	—	17 + 17	d o
"*Leiotealia*"	25—31×2	18×1—36×2	30—38×3,5—4	—	—	—

d + and *d* o = directives with and without reproductive organs.

The longitudinal muscles of the tentacles are always strong, sometimes they form very high folds. These latter are closely packed and of a palisade-shaped appearance, though they are more or less dichotomously branched. The main part of the muscles is ectodermal, here and there small parts are however enclosed in the mesogloea at the base (textfig. 160), as well as higher up on the folds (textfig. 161). I have examined specimens from all localities and all show a similar appearance of these muscles, with the exception of a specimen of Kwietniewski's *Leiotealia* (compare *Urticina felina* p. 175) which had ectodermal muscles. The muscles of the tentacles are also meso-ectodermal. The radial muscles of the oral disc in their arrangement resemble the longitudinal muscles of the tentacles. Here the folds are, however, commonly more in connection with each other in the middle part between the insertions of the mesenteries, as the textfigure 162 (St. 67) shows. At the insertions of the mesenteries the muscles are much weaker. The ectoderm of the actinopharynx contains very numerous nematocysts (compare the table).

The number of the mesenteries seems to variate considerably, as shown by the table. The smallest number in an adult individuum was 18 pairs, the largest 51 pairs. The pairs of mesenteries were besides sometimes a little more numerous on one side than on the other side. The mesenteries are evidently hexamerously arranged, though it was to be expected that with such a variable number of mesenterial pairs as 18, 32, 40 and 48 etc. (compare the table) also the cardinal number might be liable to variation. The cause of the seemingly great variation in the number of mesenteries is connected with the miscarrying of the mesenteries of the last order in certain exocoels, and sometimes with the occurrence of some other irregularities in the development. The arrangement of the mesenterial pairs in the specimen from Finmark for inst. was 6 + 6 + 6 = 18. Issuing from one pair of directives the mesenterial pairs 2, 4 and 6 of the third cycle were not developed on any side of the directive plane. The arrangement of the mesenteries in the specimen with 32 pairs (from St. 67 "Michael Sars") was 6 + 6 + 12 + 8. Of the compartments between the mesenteries of the first and second order one was typically developed with one pair of the third and 2 pairs of the fourth cycle, 5 compartments were devoid of all mesenteries of the fourth cycle, and 6 compartments contained one pair of the fourth cycle instead of two. In the specimen with 40 pairs the number of mesenterial pairs was in one half of the animal $3 + 3 + 6 + 8 = 20$, in four compartments between the mesenteries of the first and second order one pair of mesenteries of the fourth cycle was wanting. The mesenteries were commonly a little more numerous than the tentacles, in individuals with a greater number of mesenteries. In a specimen with 18 pairs of mesenteries all were perfect, in specimens with numerous mesenteries at least one half or more was perfect. The longitudinal pennons are strong and recall those of *Urticina*. Especially strong pennons were developed in the specimen from Finmark. The parieto-basilar muscles are well defined, broad, and reach to the sphincter. The basilar muscles are distinct and appear clearly under magnifying powers. Oral and marginal stomata are present, the latter are small.

The reproductive organs already appear on the mesenteries of the first order. In nearly all (4) by myself examined cases the directive mesenteries were fertile, in one case sterile.

I have not found any embryos in the coelenteric cavity of this species. The material is however too small — only three specimens were female, the other examined ones male (compare the table) — for deciding whether the young develop in the coelenteric cavity or not. On the other hand, there were in a specimen from the station 67 (Michael Sars-Exp.) lots of embryos, embedded in mucus inside a circular fold below the sphincter. I cannot with certainty decide, if we have to do with a species having the embryos attached to the outside of the column as in *Epiactis prolifera*, or if lots of young have been ejected during the strong contraction of the body, when the animal was killed. Nevertheless, the circumstance that there were marks of the embryos upon the column inside the circular folds, indicating that the embryos have been fastened there, speaks for the opinion that we have to do with a species, taking care of its brood. It would besides be peculiar, if by an eventual squeezing out of the embryos during the preservation, all embryos should have been ejected; on the contrary, it was to be expected, that at least a few had been left in the interior, but this is not the case. I therefore believe that I am not erring if I suppose that *C. spetsbergensis* is a species, taking care of its brood.

Systematic remarks. This species is probably nearly related to *Cribrina elegantissima*. It is possible, that *Leiotealia spetsbergensis* may be partly identical with my species. I conclude it hence, that Kwietniewski (1898 p. 122) declares that he has found a brood-room in the most distal part of the column of a specimen. However, Kwietniewski does not mention any verrucae. Besides, *Leiotealia spetsbergensis* is not a homogeneous species (compare p. 175).

Genus **Cribrinopsis** n. gen.

Diagnosis: Cribrinidae with commonly feebly developed verrucae (or no?) on the column. Acrorhagi and pseudo-acrorhagi absent. Sphincter strong, palmate or pinnate. Tentacles simple, thick, cylindrical, short. Longitudinal muscles of the tentacles principally mesogloeal. Radial muscles of the oral disc ecto-mesogloeal. Numerous, perfect mesenteries decamerously, hexamerously, or irregularly arranged. Well developed mesenterial muscles. Reproductive organs on the mesenteries of the first cycle and on the other stronger mesenteries, often not developed on the directives. Nematocysts in the ectoderm of the tentacles and in that of the actinopharynx of about the same length.

This genus and *Urticina* are very easily confounded. They are distinguished from one another by the distribution of the reproductive organs on the mesenteries, and by the different relation of the nematocysts in the tentacles to those of the actinopharynx. If it were to be found out in future that *Urticina* in its first adultness has reproductive organs also in the mesenteries of the first cycle, which I hold improbable (compare *Urticina felina* p. 167, 168, 174), and that these reproductive organs are later on reduced, the only important difference between the two genera lies in the above named different size of the nematocysts. Under such circumstances it is possible that we must drop the above genus and place it together with *Urticina*. So far, we have every reason for preserving it.

Cribrinopsis similis n. sp.

(Pl. 3. Fig. 7).

Rhodactinia crassicornis (O. F. Müll.) pro parte Carlgren 1902 p. 39 textfig. 6.
?Urticina crassicornis (O. F. Müll.) and *Rhodactinia Davisii* Agas. pro parte. Auctorum.
Actinostola abyssorum Carlgr. Pax 1915.

Diagnosis: Pedal disc wide. Column at least in the upper part with verrucae (sometimes inconspicuous or not present?) Sphincter pinnate to palmate. Tentacles in larger specimens from 64 to 90, commonly almost as numerous as the mesenteries, the inner longer than the outer; thick, cylindrical or a little conical, more robust than those of *Urticina*, in contracted state irregularly wrinkled or longitudinally sulcated with numerous transversal folds. Longitudinal muscles of the tentacles very strong, mesogloeal meshes fine, radially extended. Radial muscles of the oral disc strong between the radial furrows, in the furrows feeble, mesogloeal muscles fusing into the ectodermal muscles. Mesenteries commonly decamerously, more seldom hexamerously, sometimes a little irregularly arranged. Nematocysts in the ectoderm of the tentacles 34—70 × 2—2,5 (3) μ, in that of the actinopharynx 36—67 (70) × 3,5—5 μ. Spirocysts of the tentacles of variable size from 19 × 1,5 to 67 × 3 μ.

Colour?

Dimensions: The size of some of the largest, strongly contracted specimens was the following: 1) Spec. from Ikamiut: largest breadth 9 cm, height about 3 cm, length of the inner tentacles about 1,7 cm. 2) Spec. from Behring's Sea: largest breadth 8,5 cm, height 7 cm, length of the inner tentacles 3,5 cm, that of the outer 2—2,5 cm. (The tentacles were not strongly contracted).

Occurrence: New Foundland? (The bottle, containing also several *Urticina* was labelled Greenland and New Foundland).

West Greenland. Ritenbenk 15—20 fms. (Öberg 1870) (Traustedt 1892). Godhavn 70 fms. (Torell). Claushavn 10—15 fms.; 20 fms. (Öberg 1870). Christianshaab 15—30 fms. (Öberg 1870), Ikamiut (Lohmann 1905). Egedesminde (Traustedt; Bergendal 1890). Nordre Strømfiord 14—38 m. (Nordmann St. 3 b). Sukkertoppen 15—26 fms. (Öberg 1870, Holm and others), Fiskenæs 63° N. 51°10′ W. 150 fms. (Ammondsen). Bredefiord 170—180 fms. (Rink-

Exp. 1912), Ikertokfiord 5—20 fms. (Holm 1886). St. Hellefiskebanke 18 fms. (Holm 1886). 69°46′ N. 51°22′ W. 250 fms. (Tjalfe-Exp. 1908 $^{27}/_{7}$ St. 155).

Greenland without distinct locality.

West Spitzbergen: Treurenberg bay 6—30 fms. (Sw. Spitzbergen-Exp. 1861). Bell Sound Duyn Point 36 fms. (Sw. Spitzbergen-Exp. 1872—73), 30—40 fms. (Torell).

East Spitzbergen: Foster Isl. 40 fms. (Sw. Spitzbergen-Exp. 1861). W. Thymen strait 38 m, King Charles land between Jena and Abel islands 40 m, Bismark strait 35 m, Ryk-ys islands 60—80 m (Römer & Schaudinn 1898 St. 47, 32, 45, 49).

North Atlantic: 62°35′ N. 4°4′ W. 620 m. Temp. at the bottom — 0°,03 (Michael Sars-Exp. 1902 St. 67). 62°27′ N. 13°27′ W. 150 m. Temp. at the bottom probably 4°5 (Michael Sars-Exp. 1902 St. 91 (only tentacles).

Faroe islands (Müller 1900).

Norway. Finmark. (Kolthoff).

Murman coast: 75—120 fms. ("Alexander Kowalewsky" St. 191, 218 1909, teste Pax = *Actinostola abyssorum*!). Kolafiord, without distinct locality teste Pax = *A. abyssorum*!). Kolafiord (The Russian biological station Derjugin), Chewanna 30 fms. (Sandeberg-Exp. 1877), Orafiord.

Behring Island 75 fms. (Vega-Exp. 1879).

Corea strait 65 fms. ("Store nordiske" 1890).

Exterior aspect: The pedal disc is wide. The body is, according to the state of contraction, cylindrical, conical or flattened, in contracted specimens the height of the column is commonly shorter than the diameter of the base. The column is furnished with lines of verrucae which appear more or less distinctly, according to the state of contraction. In a part of the specimens I have not been able to verify with certainty the presence of verrucae, it may be possible that such ones are sometimes lacking, which is very difficult to determine in contracted and badly preserved material, above all as the verrucae are rather small. I have, however, observed that the verrucae become inconspicuous by a strong contraction of the column. As an instance I can adduce that a specimen with very distinct, though small verrucae on a great part of its circumference shows no trace of verrucae in the remaining, strongly contracted part. If the specimen had been strongly contracted in all places, it would have been considered to be devoid of verrucae. On most specimens there were however distinct verrucae. How far they expand on the column I cannot with certainty decide. On some specimens I have observed them only in the distal part, on others the distribution of them was considerably more extensive, the most proximal part is, however, probably always devoid of such. There is a well marked fossa. Acrorhagi and pseudo-acrorhagi are wanting. The tentacles variate a little in number in the examined specimens. Excepting a small, not adult specimen with only 45 tentacles, the others had from 64 to 90 tentacles (compare the table). To judge from the grouping of the mesenteries the tentacles are commonly decamerously arranged, though a hexamerous arrangement also seems to occur. They are cylindrical or in more extended state a little conical, more robust than in *Urticina*, and in contracted state irregularly folded or longitudinally sulcated with numerous transversal folds and with a distinct opening in the apex (Pl. 3 fig. 7). The outer tentacles are considerably smaller than the inner (about half as long). At the entrance to the siphonoglyphes there are conspicuous gonidial tubercles, the siphonoglyphes are well marked and furnished with well developed aboral prolongations. The actinopharynx is long and has longitudinal folds in great numbers.

Anatomical description: The ectoderm of the column is high and contains nematocysts 17—25 × 2 μ in size, in the specimen from Finmark the nematocysts were a little longer (23—30 × 2,5 μ). The verrucae seem to be of the same structure as those of *Urticina*. The mesogloea is thick and contains rather numerous, protoplasma-poor cells. The endodermal circular muscles is rather well developed. The sphincter is strong, pinnate or palmate. Two examined species were furnished with such a sphincter, as the textfig. 165 (specimen from Finmark) shows, viz. with a strong main lamella, thickening inwards; in a specimen (from the Corea strait) the sphincter was distinctly palmate without a main lamella. A specimen from Kola, Chewanna had a sphincter with a short and thick main lamella (textfig. 166).

The ectoderm of the tentacles is high and contains numerous nematocysts, which in the apex reach a size of 34—70 × 2—2,5 (3) μ. They are of the same length as those of the actinopharynx, but the latter is considerably broader (about double as broad). The size of the nematocysts and spirocysts from part of the material is given in the following table, in which also a survey of the variation of some other organs has been included (p. 160).

The longitudinal muscles of the tentacles are very strong, almost entirely enclosed in the mesogloea, and separated from the ectoderm by a commonly thick mesogloeal lamella. Towards the ectoderm the mesogloea projects into fine, sometimes ramificating off-shoots, between these there are sometimes (always?) solitary muscle-fibrils, never forming any coherent layer. These muscles are considerably thinner than those enclosed in the mesogloea and are probably in a state of reduction. The muscle meshes are in contracted tentacles radially extended, they are sometimes rather large (textfig. 167 specimen from Finmark) but commonly densely packed together (textfig. 168). Still denser meshes may occur. The radial muscles of the oral disc are not so much enclosed in the mesogloea as the longitudinal muscles of the tentacles, but the muscles here may commonly be designated as ecto-mesogloeal. Between the insertions of the mesenteries they have commonly the appearance as the textfigure 169 shows, sometimes the meshes are smaller. At the insertions of the mesenteries the muscles are weaker and commonly not so enclosed in the mesogloea as it is in the middle part between the insertions, and here it is sometimes chiefly ectodermal. The ectoderm of the actinopharynx contains numerous nematocysts of about the same length as those of the tentacles, but in breadth they are considerably larger. The size variates between 36—67 (70) × 3,5—5 μ.

The number as well as the arrangement of the mesenteries variate. The most closely examined specimens had 40 or about 40 pairs of mesenteries decamerously arranged (10 + 10 + 20; 10 + 10 + 20 + 1). In the two largest specimens the mesenteries were hexamerously arranged, in the specimen from Behring's Sea the number of mesenteries was 46 (6 + 6 + 12 + 22), on one side all the mesenteries of the 4th cycle were developed, on the other side two mesenteries of the 4th order were lacking. In the specimen from Ikamiut the number was 55 (6 + 6 + 12 + 24 + 7 — compare the table). The arrangement of the mesenteries thus seems commonly to be decamerous, though it may happen to be hexamerous. All mesenteries were perfect in the larger specimens, in the smaller specimens the last cycle was not connected with the actinopharynx. The number of mesenteries seems sometimes to be a little smaller than that of the tentacles, which indicates that also here the mesenteries grow from the basis upwards, a rule, which perhaps holds good for all Cribrinids. The longitudinal muscles of the mesenteries recall those of *Urticina*, and the pennons appear as bands, a little but deeply folded. The parietobasilar muscles are well developed, though not as strong as in *Urticina*. The uppermost part is rather narrow, and the muscles end before reaching the region of the sphincter. The basilar muscles are well developed and discoverable to the naked eye. Oral stomata are present, sometimes also marginal stomata, the latter, however, occur anything but regularly. All mesenteries are fertile, only on the directive mesenteries they are often lacking (compare the table p. 160). The species is dioecious.

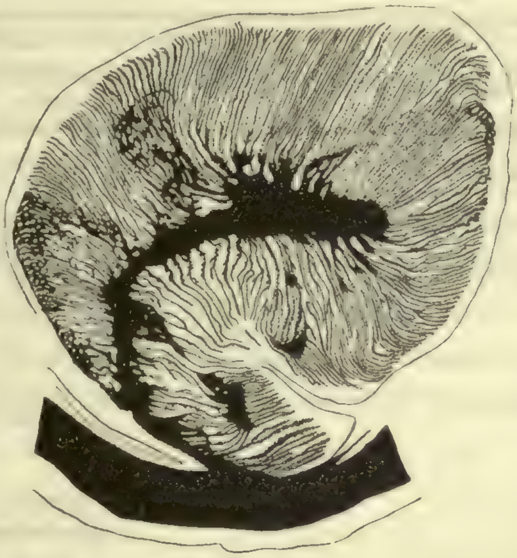


Fig. 165

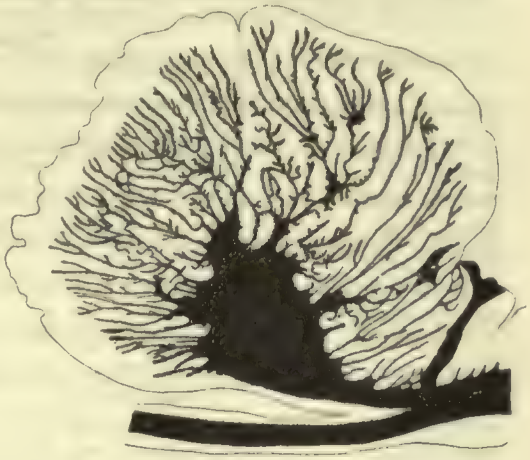


Fig. 166

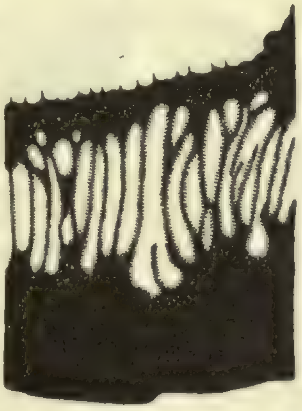


Fig. 167

Fig. 168

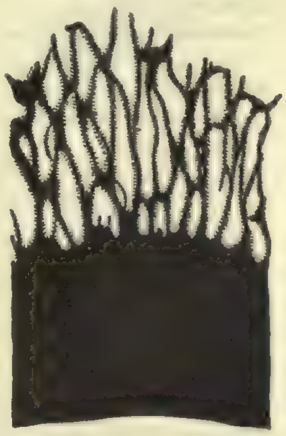


Fig. 169

Textfigs. 165—169. *Cribrinopsis similis*.
Transverse sections of sphincters (figs. 165, 166), of tentacles (figs. 167—168 and oral disc (fig. 169). (Figs. 165, 167, spec. from Finmark; fig. 166 spec. from Kola, Chewanna; fig. 169 spec. from Corea strait).

Remarks. In this specimen I have never found any embryos in the coelenteric cavity. The most closely examined specimens were however male. A specimen was a double animal, each specimen had two pairs of directive mesenteries symmetrically arranged, perpendicularly to the dividing plane.

The small fragments of the oral disc with tentacles, which Pax 1915 has determined as *Actinostola abyssorum*, certainly do not belong to this species but to *Cribrinopsis similis*. I have namely examined such tentacles taken in the Kola fiord (The Russian biological station) and labelled *Zoanthus* sp., and they were tentacles of *Cribrinopsis* (Pl. 3 fig. 7). The exterior aspect and the arrangement of the muscles are about the same in both species, but the size and the structure of the nematocysts are very different. I have often found such torn-off tentacles in *Cribrinopsis* from different localities.

Habitat	tentacles nematocysts	tentacles spirocysts	actinopharynx nematocysts	number of mesenterial pairs	number of tentacles	verrucae	distribution of the reproductive organ on the directives
Sukkertoppen	42—60 × 2,5(3) μ	—	42—53 × 3,5—4,5 μ	20+20	64	?	♀ d:o
Claushavn	43—60 × 2,5	22 × 1—1,5—53 × 2—2,5 μ	55—62 × 3,5	40	80	+	♀ d:o
Foster's islands	41—55 × 2,5	22 × 1,5—50 × 2—2,5	55—66 × 4—4,5	41	82	+	♂ d:o
Corea strait	41—53 × 2,5	19 × 1,5—50 × 2,5	41—50 × 4—4,5	20+20?	about 80	?	♀ d:o
Behring's sea	46—62 × 2,5	24 × 2—67 × 3	46—62 × 3,5—5	22+24	79	?	♂ d:+
Ritenbenk	55—67 × 2—2,5	—	48—60 × 3,5—4,5	20+21	—	+	♀ d:o
Bell Sound	46—65 × 2—2,5	—	48—58 × 4—4,5	—	78	—	—
—	38—50 × 2—2,5	—	42—53 × 4—4,5	—	—	—	—
Egedesminde	50—70 × 2	22 × 1,5—50 × 2—2,5	—	—	—	—	—
Treurenberg bay	50—68 × 2—2,5	—	50—67 × 3,5	20+21	71	+	♂ d:?
250 fms. Torell (Locality ?)	46—63 × 2—2,5	—	46—58 × 3,5—4,5	—	—	+	—
Duyn Point	48—62 × 2—2,5	—	58—67 × 4,5—5	—	—	+	—
Fiskenæs	—	—	48—60 × 4,5—5	probably decamerous	—	+	♂ d:o
Ikamiut	43—60 × 2,5—3	72 × 1,5—50 × 2	48—55 × 4,5	26+29	90	+?	♂ d:o
Greenland (without distinct locality)	43—55 × 2,5	24 × 1,5—48 × 2,5	43—55 × 4—4,5	20+21	79	?	♂ d:o
Bredefiord	49—60 × 2—2,5	—	53—58 × 5	—	—	—	—
Greenland (without distinct locality)	43—58 × 2	—	—	—	79	—	—
St. 47 (Römer & Schaudinn)	36—54 × 2—3	22 × 1,5—43? × 2,5	43—58 × 4—5	—	72	+	—
St. 32 (Römer & Schaudinn)	43—58 × 2,5	—	46—60 × 4—5	—	72	+?	—
Greenland locality?	46—55 × 2 (2,5)	—	48—55 × 4,5	—	80	+	—
Faroe islands	48—61 × 2—2,5	—	48—55 × 5	—	—	+	—
Sukkertoppen	48—55 × 2—2,5	—	49—58 × 4,5	20+20	—	+	—
—	38—52 × 2,5	—	46—60 × 4,5—5	—	—	+	—
—	46—60 × 2—2,5	—	46—58 × 4,5	—	—	+	—
Murman coast (only tentacles)	55—67 × 2	—	—	—	—	—	—
Ora fiord (small spec.)	31—43 × 2,5	—	—	—	—	—	—
Finmark	39—55 × 2—2,5	19 × 1,5—46 × 2—2,5	46—55 × 4—4,5	20+?	80	—	no reprod. organs
Egedesminde	43—62 × 2,5	22 × 1,5—53 × 2—2,5	48—62 × 3,5—4,5	20+20	about 78	+?	♀ d +

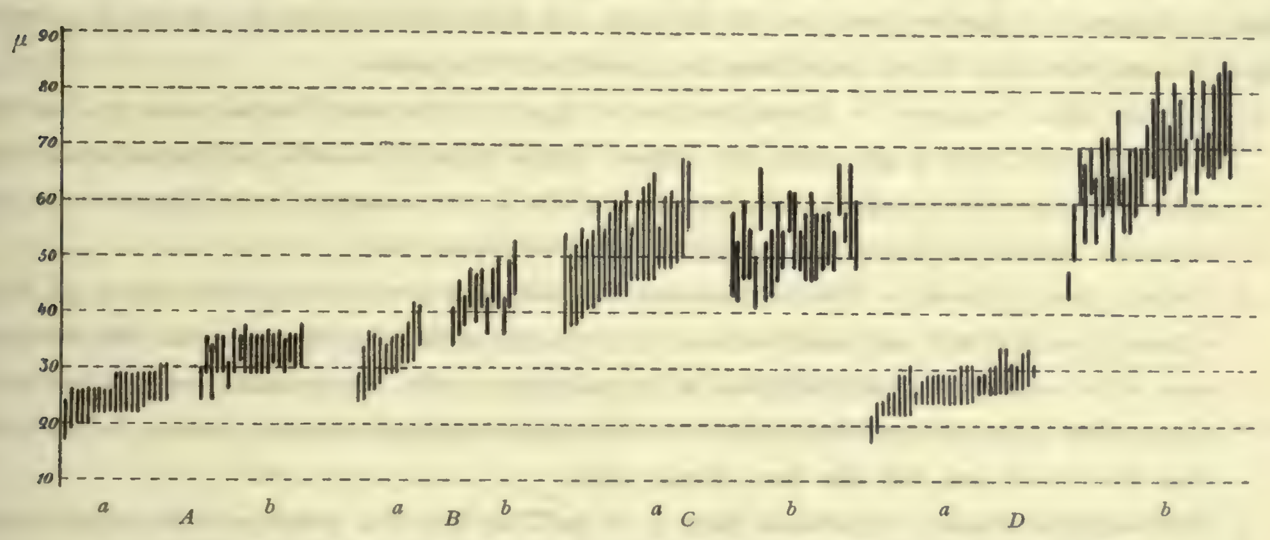
verrucae + = v. present. d +, d:o = reproductive organs on the directives present resp. absent.

Genus Urticina Ehr.

Diagnosis: Cribrinidae with well developed pedal disc and rather low body. Column with verrucae or without. Acrorhagi and pseudoacrorhagi absent. Sphincter strong, palmate or pinnate. Tentacles simple, thick, cylindrical, short. Longitudinal muscles of the tentacles from ectodermal to ecto-mesogloeal (mesogloeal?). Radial muscles of the oral disc from ectodermal to meso-ectodermal. Numerous perfect mesenteries decamerously (during the development hexamerously) arranged. Well developed mesenterial muscles. The six primary pairs of mesenteries always sterile. The 10 or the 20 strongest pairs mostly without reproductive organs. Nematocysts in the ectoderm of the tentacles and in that of the actinopharynx of very different size.

As before pointed out, it is very difficult to distinguish *Urticina* from some other genera, especially if the reproductive organs are lacking. The specimens provided with verrucae have certainly been confounded with specimens of *Cribrinopsis*, sometimes also with certain species of *Cribrina*, and the smooth forms with *Epiactis-* and *Leiotealia*-species. To him who has more closely examined the Northern species of these genera, the explanation of such a mistake is very simple, because these genera display a great variation in some of their anatomical characters, as is evident from the description given here. Only through a study of the stinging capsules it has become possible to lay a sure foundation for future works on this family. It has namely been proved that the stinging capsules are good characters of the species, and mostly also of the genera. In my paper of 1902, in which I have described *Rhodactinia crassicornis* and mentioned *Tealia lofotensis* and *coriacea*, I made myself liable to some mistakes because I had not examined the size of the stinging capsules at the time when I wrote my paper. I have for inst. in the description confounded *Cribrinopsis* with some *Urticina crassicornis*, not provided with reproductive organs but with embryos in the coelenteric cavity.

In order to show the difference in the size of the nematocysts of the tentacles (*a*) and of the actino-



Textfig. 170. Diagram of the size of the nematocysts in some Cribrinids (compare the text!)

pharynx (*b*) of some examined Cribrinids, I have in the textfigure 170 put together the length of the nematocysts. The size of the nematocysts in *Cribrina stella* (*A*) is measured in 19 specimens, in *Cribrina spetsbergensis* (*B*) in 12, in *Cribrinopsis similis* (*C*) in 23, and in *Urticina felina crassicornis* (*D*) in 30. The length of the lines represents the variation in μ of the length of the nematocysts in the different specimens. While the length of nematocysts in *Cribrinopsis similis* is about the same in the tentacles and in the actinopharynx, it is more or less different in the other species; the difference is especially great in *Urticina felina*. As the table shows, these species are easily identified by examinating the size of the nematocysts. I especially wish to point out how important the nematocysts may be to the systematizing, and to call the attention to the fact that the size of the nematocysts is as good a systematic character as any other.

Urticina felina (L.) Marenz.

Pl. 4. Figs. 1—4.

Diagnosis: Number of tentacles and mesenteries unto about 160. Tentacles in contracted state longitudinally sulcated. Nematocysts of the column smaller than those of the tentacles, those of the actinopharynx from two and a half unto three times larger than the larger nematocysts of the tentacles. Nematocysts of the column in fertile specimens partly 12—29 × 1,5—2 μ, partly 8—12 × 1 μ, very sparse, especially the latter; those of the tentacles 17—34 × 2—2,5 μ, partly 12—17 × 1—1,5 μ, the latter very sparse, those of the actinopharynx very numerous, 45—91 × 4,5—7 μ.

The genus *Urticina* now is easily distinguished from other Cribrinids by aid of the nematocysts. It is more difficult to say, whether we have to do with more than one *Urticina*-species in the Northern and Arctic seas. There is no doubt that in those seas there are different *Urticina*-forms which are certainly rather easily distinguished from each other alive, but whether these form are different species (Carlgren 1902) or variations of one and the same species (Mc. Murrich 1911) is a question. For practical reasons it is more suitable to accept the latter view, as the different forms in contracted and badly preserved state are difficult to distinguish. I, therefore, here treat the Northern and Arctic *Urticina*-forms as varieties of a single species: *Urticina felina* (L.). To my mind there are 4 varieties of this species.

1) *Urticina felina crassicornis* = *Rhodactinia davisii* Agas. = "the true *Urticina crassicornis* of the North" (Verrill 1868 p. 470 note). The column of this variety is smooth, without verrucae, the embryos develop unto a stadium with numerous tentacles in the coelenteric cavity, the tentacles are uniformly coloured or almost so. An Arctic and Boreoarctic form.
2) *Urticina felina lofotensis* = *Urticina crassicornis* f. *laevis* Carlgren in Appelløf 1900 p. 4). The column is provided with very small verrucae, in contracted state often inconspicuous. The development of the embryos does not take place in the coelenteric cavity. The tentacles are furnished with more or less indistinct transverse bands, or are sometimes uniformly coloured. A large Boreal form from the littoral area, but also from deeper water.
3) *Urticina felina coriacea* = *U. coriacea* Rapp = *U. papillosa* Ehr. The verrucae of the column large. Development of the embryos probably as in the previous form. Tentacles with more or less distinct transverse bands. A Boreal-Lusitanic form of the littoral area.
4) *Urticina felina tuberculata* = *U. tuberculata* Cocks (compare Walton 1908 p. 218). Verrucae smaller than in *U. felina coriacea*. Otherwise as the former variety, but of greater size. A Boreal form from deep-water.

Of these forms *coriacea* and *tuberculata* are probably most closely related. In the review of the literature I have put them together. As the verrucae display a different appearance in different states of contraction it is sometimes difficult to determine the varieties with certainty. I have therefore added *lofotensis* to the list of occurrence of *coriacea* and *tuberculata*. The varieties, which I believe I have been able to determine with certainty, I have designated (c) = *coriacea*, (l) = *lofotensis*. The other forms from deep water are most probably *tuberculata*. I myself have seen only *coriacea* and *lofotensis* (Appellöf's specimens in Bergen, specimens from Drontheim fiord and 1 specimen in Bohuslän) in living state.

From an anatomical point of view these varieties seem to be equal, except as far as the presence or absence of verrucae is concerned. It is possible that the difference in size between the larger nematocysts of the tentacles and those of the actinopharynx is somewhat greater in *coriacea* and *tuberculata* than in *lofotensis* and *crassicornis*, but this question demands a closer examination of numerous specimens, determined in living state. Concerning the size of the larger nematocysts in the tentacles and of those in the actinopharynx it is noticeable that as a rule it increases to a certain degree simultaneously with the growth of the specimens. A smaller specimen has thus smaller nematocysts than a larger specimen, but the proportion between the size of the nematocysts in the tentacles and that of the nematocysts in the actinopharynx is retained, as the following tables clearly show.

Urticina felina coriacea & tuberculata.

Priapus felinus, Linné 1761 p. 510.

Actinia felina L., Linné 1766—68 p. 1088.

Tealia felina L., Fischer 1875 p. 1207/7).

Urticina felina (L.), Haddon 1889 p. 298.

Actinia coriacea Cuv., Rapp 1829 p. 51 Pl. 1 figs. 3, 4, Sars 1835 p. 3 Danielsen & Koren 1856 p. 87.

Cribrina coriacea Cuv., Ehrenberg 1834 p. 40.

Cereus coriaceus Milne-Edwards 1857 p. 264.

Tealia coriacea (Cuv.), Carlgren 1902 p. 43, Walton 1908 p. 219.

Actinia (*Isacmaea*) *papillosa*. *Urticina papillosa* Ehrenberg 1834 p. 33.

Cereus papillosus Milne-Edwards 1857 p. 264.

Actinia tuberculata n. sp., Cocks 1851.

Tealia tuberculata Cocks, Gosse 1860 p. 217, Cunningham 1890 p. 205 Pl. 19.

Actinia crassicornis Müll., Gosse 1853 p. 74, (*Cribrina* v. *Tealia*) Lütken 1861 p. 191. Möbius 1873 p 100. Lenz 1882 p. 171.

Bunodes crassicornis (Müll.), Gosse 1855 p. 294, Meyer & Möbius 1862 p. 231, 1863 p. 174.

Tealia crassicornis (Müll.), Gosse 1858 p. 417, 1860 p. 209 Pl. 4 fig. 1. O. & R. Hertwig 1879 Pl. 2 figs. 2, 6, 7, 9, 12, Andres 1883 p. 415 fig. 24, Möbius 1883 p. 12, G. Y. & A. F. Dixon 1889 p. 320 Pl. 5 fig. 5, Levinsen 1893 p. 395, Mortensen 1897 p. 316, Grieg 1898 p. 6, Blegvad in Petersen 1914 p. 43.

Urticina crassicornis Ehr.! Verrill 1869 p. 469 (p. p.), (Müll.) Carlgren 1893 Pl. 1 fig. 20 textfigs. 9—13 (p. p.), Appellöf 1905 p. 83, 86, (Ehr.) Pax 1920 p. 7 figs. 3—6. ?(Müll.) Ehr. Mc. Murrich 1901 p. 28 fig. 2 Pl. 1 fig. 6.

?Rhodactinia davisii Agas. Verrill 1864 p. 18 (p. p.).

Tealia grenii n. sp. Wright-Perceval 1859 p. 122.

Actinia holsatica n. sp. Müller 1806 p. 23 Pl. 139.

Compare further Andres 1883 and Carlgren 1893.

Diagnosis: Compare above.

Colour of *coriacea* very variable. Column now crimson, now with green streaks and crimson flakes, now ochreous-coloured or olive-brown, now grayish. Warts gray or bluish-gray. The main colour of the tentacles is white or gray, shading off into bluish-gray or pale crimson. An opaque white band across the base of the tentacles and a broad crimson-coloured band in the middle, below and sometimes above outlined by a narrower band of opaque white colour. Sometimes these bands are indistinct. Oral disc grayish or glaucous-olive, around the inner tentacles with radial bands, now white or yellowish-white, now ochreous-coloured; between the bands the oral disc is crimson-coloured. Mouth generally with crimson or red-brown tinges. Gonidial tubercles crimson-coloured. (Gosse, Carlgren).

Dimensions: *tuberculata* in contracted state: breadth unto 9 cm, height unto about 6 cm, *coriacea* is smaller.

Occurrence: Norway. Lofoten Saltströmmen 90 fms. (*l*) (Norw. N. Atl.-Exp.), Dronthjem fiord Skarnsund 60—200 m (*l*) (Östergren, Pettersson), Beian (Huitfeld-Kaas), Florö (*c*) (Sars), Vaagsfiord (teste Grieg), Bergen, Godösund (*l*) (Nordgaard), Bergen (*l*) (Appellöf), Bergen Sölsvig (Sars), Jäderen 100 fms. (Olsson), Flekkefiord 150—200 fms. (Fjörsvaag), Farsund.

North Sea. Great Fisher Bank N. W. of Bergen 60—200 fms. (Swedish fishermen), W. N. W. of Bergen 80—170 fms. (Lambert), S. W. of Haugesund at Bergen 15—24 miles from land 100—170 fms. (Swedish fishermen), N.W. of Egersund 100 fms. (Swedish fishermen), Jydske Rev 50—200 fms. (Uddström, Nilsson and other fishermen).

Faroe Isl. (*c*) (Müller), Thorshavn (*c*).

64°27′ N. 13°27′ W. 150 m. Bottom temp. 4,5 (probably *l*) (M. Sars-Exp. 1902 St. 91).

Skagerrak 140 m (Thor-Exp. 1903), Kosterfiord N. Hellsö (*c*) (Aurivillius).

Cattegat. Bohuslän Strömmarne, Gåsöränna and other localities at a few fms. (*c*) (Carlgren and others), Bohuslän without distinct locality (B. Fries, Stuxberg), Zool. Station 1 sp. from deep water (*l*) (Carlgren), Laholm bay Kattvik 8 m (*c*) (Lönnberg); S.E. of Muldbjergene 12 m (teste Blegvad), E. of Munkegrund 40 m (teste Blegvad), 1/2 1/4 miles E.N.E. of Lillegrund (teste Blegvad).

The Sound. Hellebæk (*c*) (Jungersen), off Helsingborg 20 fms. (Gunhild-Exp. 1878), Landskrona (*c*) (Örsted), N. of Hven 25 m (teste Blegvad).

Denmark. Livø Bredning (teste Blegvad), Thisted Bredning 11—12 m. (teste Blegvad), Limfiord (teste Mortensen), Samsø (Lütken teste Levinsen), Isefiord Frederiksund (Feddersen teste Levinsen), Adelvig (*c*) (Lundbeck), Odensefiord Hofmansgade (*c*) (Steenstrup, Lütken), Little Belt, Strib & Faenö (*c*) (Lütken), Svendborg Sound (Steenstrup, Lütken teste Levinsen).

Baltic Sea. Kieler Bucht, Bülk (teste Meyer & Möbius) Cadetrinne 15,5 fms. (teste Möbius), Travemünde Bucht, Niendorf Haffkrug 2—9 fms. (teste Lenz), S. of Bornholm 8—9 fms. (*l*) (Mortensen 1891).

Further distribution: British Islands, English Channel, Atlantic coast of France, Vendée, Charente-Inférieure; ?Atlantic coast of N. America to Cape Cod. ? West Coast of N. America. Puget Sound Port Townsend. (The North American *Urticina* requires closer examination. Whether the real *Urticina* *felina coriacea* with large warts occurs there, seems a little doubtful to me. Besides *crassicornis*, we probably have to do with *tuberculata* or *lofotensis*).

Exterior aspect: The exterior of this form has before been described by various authors, also by myself (1893). It is not necessary to recapitulate the description here.

Anatomical description. Several authors, also I myself (1893) have described the anatomy of this form. As however several facts can be added, concerning the structure of various organs, it may be practical to make these organs subject to a reexamination.

Concerning the structure of the verrucae I have, after an examination of the maceration preparations, been able to determine the nature of "the pyriform cells", which Mc. Murrich (1889 p. 53) supposed to be "nerve ganglion cells", and on which he later (1911 p. 76) pronounced the opinion that they "may possibly be muscular in character." Already 1899 p. 11[1] I have, however, pointed out that the pyriform cells are granulous gland cells, "die in dem proximalen Theil des Ektoderms langgestreckt birnförmig sind nach aussen dagegen einen sehr feinen Ausführungsgang haben." A comparison between the ectoderm in the middle part of the verrucae, viz. the part, which in contraction is a little concave, and the ectoderm in the side-parts, with which the other ectoderm of the column agrees, shows, that the middle part is constructed in another way than the other parts of the column. The figures 1, 2, Pl. 4 show the cells occurring in the middle part after a treatment with the maceration liquid of Hertwig (osmium & acetic acid. Hertwig 1879). In the figure 1 Pl. 4 the maceration is imperfect, in as much as the cells are still joined in the distal part, while their basal parts are separated. Already here we can see that the ectoderm cells consist of elongated supporting cells and granulous gland cells, which is still more conspicuous as the cells are perfectly isolated (Fig. 2, Pl. 4). The granulous gland cells are thus the pyriform cells. They are namely swollen near the basal part of the ectoderm, while the main part forms a long efferent duct, and recall in their appearance the gland cells of the pedal disc, though the latter are more irregular (Fig. 3, Pl. 4) than the former. There is thus no doubt that the pyriform cells are gland cells. Macerative preparations of the ectoderm outside of the peculiar verrucae, viz. on the rim of the concave part and between the verrucae, show the presence of supporting cells, of nematocysts, of mucus-cells (Fig. 4 a, Pl. 4), and of granulous gland cells. These last cells, however, are of quite another structure than the gland cells of the verrucae. As we see from the figure 4b (Pl. 4), they are shorter and broader in the distal part than in the filiform proximal part, which is devoid of granules, and a little coloured. The secretion of the pyriform cells probably is of small importance to the adhesion of foreign bodies, neither do the gland cells of the pedal disc play any essential part by the adhesion of the pedal disc.

[1] Wassilieff (1908 p. 99) has proclaimed that in my papers of 1893 and of 1899 I have made myself guilty of an inconsequence, concerning my statements of the structure of the verrucae. Concerning the nematocysts he seems to be right. In the main there are no nematocysts in the ectoderm of the verrucae, but where they are adjacent to the other ectoderm of the column, which contains nematocysts, glandcells etc., solitary nematocysts and also common gland cells may pass into the outermost part of the peculiar verruca, while the main part of the verruca contains no nematocysts. Hence my different statement: sparse nematocysts and no such. Concerning the gland cells in the verrucae I have in my paper 1893 not been able to decide the nature of the pyriform cells, wherefore I also 1893 declared that there were no gland cells in the verrucae. The statement of Wassilieff, that the verrucae of *Cribrina japonica* have the same structure as the other ectoderm of the column, is certainly due to the sections not having hit the middle part of the verrucae. On the other hand, he describes the verrucae of *Anthopleura mc. murrichi* in the same manner as I (1899 p. 11) have described them in *Urticina* and *Condylactis cruentata*. The classification of the verrucae in "Saugwarzen" and "Klebwarzen" (Pax 1914 p. 360) does not hold good. Pax has evidently not observed my statement of 1899.

The structure of the sphincter varies from palmate to pinnate, and affords no good character neither of the species nor of the genus.

The longitudinal muscles of the tentacles are mesogloeal, as already observed by O. and R. Hertwig 1879. They, however, show a certain variation, in as much as they are now ecto-mesogloeal now meso-ectodermal. It was therefore formerly supposed that the mesogloeal tentacle muscles were characteristic of *Urticina felina coriacea*. In fact the variation is still greater, as I have in small, but sexually ripe specimens found a perfectly ectodermal longitudinal muscularity of the tentacles. I have in the textfigure 171 reproduced a transverse section of part of the tentacular muscles and the mesogloea of one of the below named specimens from Hellebæk, which certainly is a real *U. felina coriacea*. The specimen has namely well-developed verrucae, its sphincter is palmate, the mesenteries show the arrangement, characteristic of *Urticina*, and the nematocysts in the actinopharynx and tentacles agree with those of this species. For comparison I have in the textfigures 173, 174 reproduced transversal sections of two pieces of tentacles of an *Urticina* from Heligoland. On one piece we find a comparatively thin mesogloeal lamella outside of the rather fine muscle meshes, the part of the mesogloea facing the ectoderm here and there displays distinct muscles. On the other piece the comparatively few meshes are found wholly within the mesogloea; whether there are muscles to be found also on the ectodermal side, I will leave undecided, as, upon all accounts, if present they are very weak. The two latter figures have been reproduced from the same section, which shows that the variation is very great at the same level of a tentacle. The longitudinal muscles of the tentacles of *Urticina* thus vary from ectodermal to ecto-mesogloeal, possibly to wholly mesogloeal.

Fig. 171

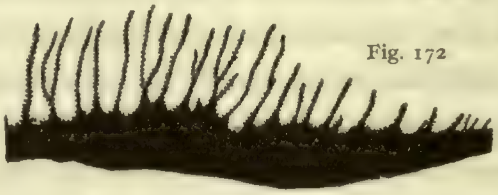


Fig. 172

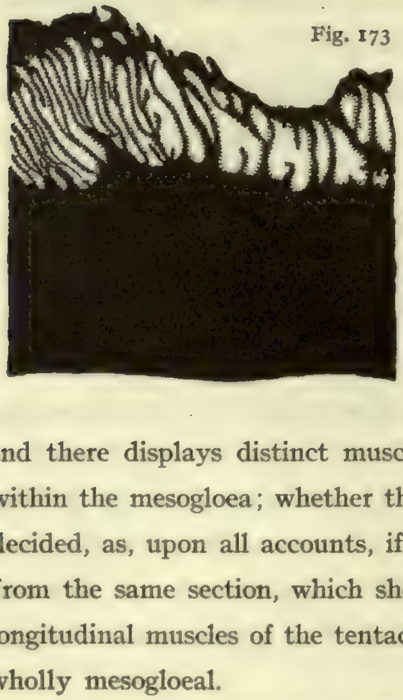


Fig. 173

Fig. 174

Textfigs. 171—174.
Urticina felina coriacea.
Figs. 171, 173, 174 Transverse sections of a part of some tentacles. Fig. 172 Transverse section of a part of the oral disc. Figs. 171, 172 spec. from Hellebæk, figs. 173, 174 spec. from Helgoland.

The radial muscles of the oral disc agree with the longitudinal muscles of the tentacles. I have before (1893) shown that they are ecto-mesogloeal or perhaps more correctly meso-ectodermal. In the textfigure 172 part of a transverse section through the oral disc of the above named specimens from Hellebæk has been reproduced. As we see, the radial muscles are ectodermal.

Thus longitudinal muscles of the tentacles and the radial muscles of the oral disc vary from ectodermal, in smaller but sexually ripe specimens, to more or less mesogloeal, in middle-sized and large specimens. In other words, the folding of the ectodermal muscle lamella into the mesogloea, or the fusion of the peripheric mesogloeal off-shoots here evidently takes place rather late. Probably we here namely have to do with two different modes of development of the mesogloeal muscles. On the section, reproduced in the textfigure 174, the rather large, at last mesogloeal meshes may gradually have passed into the mesogloea, while on the section, reproduced in the textfigure 173, the peripheric end of the mesogloeal offshoots have fused with each other, the mesogloeal lamella, separating the meshes from the ectoderm, is namely often very thin (compare the figure of *U. felina* = *crassicornis* O. F. Müll. Mc. Murrich 1911 Pl. 2, fig. 4).

Also the distribution of the reproductive organs varies. I have stated 1893 that the 10 first pairs of mesenteries of *Urticina crassicornis* (= *U. felina coriacea*) are sterile. Later on I have examined other specimens and found this statement confirmed, or that also the 10 pairs of the second order are completely or partly sterile. Mc. Murrich (1901 p. 34) declares that in *U. crassicornis* (a verrucous species from Puget Sound) the two first cycles of mesenteries are devoid of reproductive organs. In two more closely examined specimens from Hellebæk (compare above), the size of which in contracted state was 0,7 cm in height and 1 cm in breadth, but still provided with well-developed reproductive organs (testes with spermatozoa), it appeared on sections that of the older mesenteries only 6 pairs were sterile. One specimen was provided with 40 pairs of mesenteries and thus, as to the number of the mesenteries, in the stage, reproduced by Faurot (1895 p. 139). In the proximal part of the actinopharynx there were, however, 6 pairs perfect; whether in the distal part some more mesenteries are perfect, I have not examined. Faurot has shown that the decamerism of *Urticina* is due to the fact that the development of the mesenteries in the ventro-lateral compartments is retarded. Thus in the dorso-lateral and the lateral compartments there is one cycle more than in the ventro-lateral compartment. The 10 first pairs consist of 6 pairs of the first cycle and of 4 of the second (in the dorso-lateral and lateral exocoels). The 10 following pairs, alternating with the former, are formed by 2 pairs of the second order (in the ventro-lateral exocoels) and 8 pairs of the third order (in the other exocoels). The 20 following pairs have arisen as 4 pairs of the third order (ventro-laterally) and 16 pairs of the fourth order. The arrangement of the reproductive organs of the specimens was as follows. The figures indicate the different cycles, if we issue from a species with the mesenteries originally arranged after the number of 6. The decamerism of *Urticina* is namely, as above named, derived from a species with originally 6 pairs of mesenteries. The spaced out figures indicate the fertile mesenteries. *dm*: directive pairs.

dm (over first 1) … dm (over the 1 following 3 2 3)

1 4 3 4 2 4 3 4 1 4 3 4 2 4 3 4 1 3 2 3 1 3 2 3 1 4 3 4 2 4 3 4 1 4 3 4 2 4 3 4

The arrangement of the mesenteries in the second specimen, having 43 pair, was the following.

dm (over first 1) … dm (over the 1 following 3 2 3 4)

1 4 3 4 5 2 4 3 4 1 4 3 4 2 4 3 4 1 3 2 3 4 1 3 2 3 4 1 4 3 4 2 4 3 4 1 4 3 4 2 4 3 4

In this specimen two pairs of the fourth cycle (in the ventrolateral compartments) and one pair of the fifth (in a dorso-lateral compartment) are added. Here we find, that also the mesenteries of the third cycle in the ventro-lateral compartments, and 3 pairs of the fourth cycle in a primary lateral compartment, are provided with reproductive organs.

If we compare those results with the former observations, we may conclude that the position of the reproductive organs varies with the age of the animal; in the youngest specimen (an examined specimen still smaller than those mentioned above had no reproductive organs developed) the six first pairs are sterile, in older ones the 10 first pairs (the first decade) are devoid of reproductive organs, and in large specimens the sterility sets in with the 20 oldest pairs; in other words the generating region moves during the lifetime of the animal to more and more younger mesenteries, simultaneously with the increase in the number of mesenteries. A similar, though less positive case I have observed in *Allantactis parasitica*, in which the mesenteries of the second cycle sometimes are sterile. Commonly the distribution of the reproductive organs in the Actiniaria is constant or almost so, especially the forms in which the first order of mesenteries is fertile; though it is possible that sometimes such a moving of the reproductive organs takes place. I especially think of such forms as *Bolocera*, in which the distribution of the reproductive organs varies.

The size of the nematocysts is shown on the following table.

Habitat	length and breadth of the spec.		Nematocysts of the tentacles	Nematocysts of the actinopharynx	varieties
1. Skagerrak (Thor)	6,5 cm	9,5 cm	24—34 × 2—2,5 μ	74—85 × 5—6 μ	probably tuberculata
2. Jydske Rev	5	6	24—26 × 2	72—82 × 5,5—6 (7)	» »
3. Faroe Isl.	—	—	25—29 × 2	67—79 × 5	coriacea
4. — —	4	6,5	24—26 × 2	60—79 × 5	»
5. S. W. of Bergen	4	4,5	(21)24—29 × 2 (2,5)	70—74 × 5,5	probably tuberculata
6. Gullmarfiord	2	2	17—22 × 1,5 almost 2	45—60 × 5	coriacea
7. Hellebæk	0,7	1	19—23 × 1,5 almost 2	43—55 × 4,5—5,5	»
8. Gullmarfiord	0,4	0,4	16—23 × 1,5	49—56 × 4,5—5,5	»

The specimens 1 and 6 were rather well expanded, the others much contracted. The size of the spirocysts was in the spec. 1, 24 × 1,5—50 × 2,5 μ, in the spec. 3, 22 × 1—46 × 2 μ, in the spec. 7, 14 × 1—24 × 2 μ. The nematocysts of the column were in the column of the specimen 1, 19—26 × (1,5)—2 μ, in that of the specimen 6, 12—19 × 1,5—2 μ. In the column I have also found scattered spirocysts. Smaller nematocysts than the above named I have observed in the column and in the tentacles, but they are very rare (compare *lofotensis* and *crassicornis*).

Urticina felina lofotensis.

Madoniactis lofotensis n. sp. Danielssen 1890 p. 47 Pl. 1 fig. 5 (p. p.).
Urticina crassicornis f. *laevis* Carlgren in Appellöf 1900 p. 4.
Tealia lofotensis (Dan.) Carlgren 1902 p. 42.
Rhodactinia crassicornis (Müll.) Walton 1908 p. 218, Arndt 1912 p. 124.
?Rhodactinia davisii Agas. Verrill 1864 p. 18 (p. p.).
?Bolocera eques n. sp. Gosse 1860 p. 351 Pl. 9 fig. 6.
? — — Gos. Norman 1868 p. 318, Stephenson 1918 b p. 112.

Diagnosis: Compare p. 162.

Colour: Column and pedal disc yellowish-red with dark-red partly stripes and partly patches. Tentacles transparent, pale yellowish-red with 1 to 2 broad, red annuli besides the one at the base. Oral disc rose-coloured with fine, red folds, issuing from a red annulus round the mouth and extending towards the tentacles, where they form a bright-red annulus (*Madoniactis* Danielssen). Column dirty-yellow, brownish or brown-red, sometimes with red or reddish, longitudinal spots. Tentacles sometimes uncoloured, sometimes dirty-yellow, brownish or brown-red, frequently with more or less distinct, paler or darker transverse bands, sometimes the tentacles are crimson-coloured (*U. crassicornis* f. *laevis* Appellöf). Compare also Walton 1908 p. 218—219.

Dimensions in contracted state unto about 5,5 cm broad and 2,5 cm high.

Occurrence, compare *U. felina coriacea.*

Exterior aspect. The type-specimen, dredged by Danielssen, was much contracted in oral-aboral direction. Therefore I cannot decide, whether the column is furnished with small verrucae or not, but Danielssen declares that there are such. Besides, the description of the species, given by Danielssen, has been compilated also from *Metridium senile* (*dianthus*) (compare Carlgren 1902 p. 42). Appellöf's specimens (Appellöf 1900 p. 4) as also those collected by Nordgaard, are provided with small verrucae. In the not sexually ripe specimen, dredged by Mortensen S. of Bornholm, I cannot see any verrucae by aid of a magnifier, but on the sections there are scattered excavations in the column, indicating the presence of small verrucae. Therefore I think that this specimen is forma *lofotensis* and not *crassicornis.*

Fig. 175

Fig. 176

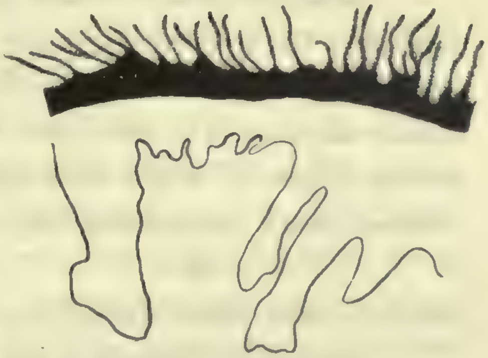


Fig. 177

Textfigs. 175—177. *Urticina felina lofotensis* from Bornholm. Transverse sections of the sphincter (fig. 175) of a part of the oral disc (fig. 176) and of a part of a tentacle (fig. 177).

Anatomical description: Concerning the anatomy of this form I have not much to say. Small specimens agree with such of *U. felina coriacea*, in as much as the longitudinal muscles of the tentacles and the radial muscles of the oral disc are ectodermal (textfig. 176, 177). The sphincter of the Bornholm-specimen (fig. 175) differs somewhat from the typical appearance of the sphincter of *Urticina.* The size of the nematocysts (*n*) and spirocysts (*sp*) of some specimens I have given below.

Habitat	length and breadth of the specimens		column *n*	tentacles *n*	tentacles *sp*	actinopharynx *n*
Saltstrømmen (type)	1,5 cm	5 cm	20—23 × almost 2 μ	24—29 × 2—2,5 μ	—48 × 2,5 μ	62—77 × 5—6 μ
Bergen (Appellöf)	2,5	5	22—26 × about 2	26—31 × 2—2,5	—	60—80 × 5—5,5
Bornholm.............	0,3	2,2 × 1,5	17—22 × almost 2	22—26 × almost 2	17 × 1,5—26 × 2	43—55 × 5
Drontheim fiord........	2,5	5,5	19—24 × almost 2	24—29 × 2	—	70—82 × 6 (7)

In the column of all species I have found also smaller nematocysts, 7—12 × 1,5 μ. The nematocysts of the column are sparse, especially the smaller ones. Scattered spirocysts are also observed in the column. In the tentacles I have sometimes observed smaller nematocysts of about the same size as those of *U. felina crassicornis*.

Urticina felina crassicornis.

Actinia crassicornis n. sp. Müller 1776 p. 231, Fabricius 1780 p. 348, 1797 p. 52, Lütken 1875 p. 186.

Urticina crassicornis Ehr.! Verrill 1868 p. 469, 1885 p. 534 (p. p.), Müll. Carlgren 1893 p. 58 (p. p.), 1901 p. 470 fig. 2 a, b.

Rhodactinia crassicornis Müll., Carlgren 1902 p. 40 figs. 4, 5 (p. p.).

— *davisii* n. sp. Agassiz 1847 p. 677.

— — Agas. Verrill 1863 p. 57, 1864 p. 18 Pl. 1 fig. 9 (p. p.), Agassiz 1865, 1871 p. 13 fig. 10, Packard 1865 p. 263, ?Pax 1915.

Urticina (*Rhodactinia, Tealia*) *davisii* Agas. Carlgren 1916 p. 1.

Tealia davisii Agas. Breitfuss 1904 p. 6, Carlgren 1905 p. 511 fig. 1.

— *crassicornis* (Müll.) Parker 1900 p. 752 (p. p.).

Tealia sp.? Carlgren 1893 b p. 213.

Leiotealia spetsbergensis n. sp. Kwietniewski 1896 p. 134 (p. p.).

Actinia obtruncata n. sp. Stimpson 1853 p. 7.

Actinia (?) *felina* L. Milne-Edwards 1857 p. 242.

Urticina felina L. Marenzeller 1877 p. 23, Stuxberg 1886 p. 163, 186, Mc. Murrich 1911 p. 65 Pl. 1, 2, 3 fig. 1.

Bolocera tuediae Johns. Aurivillius 1886 p. 52.

Diagnosis: Compare p. 162.

Colour: Column uniformly red or else with a ground colour of pale red or yellowish, upon which were closely set, irregular blotches and streaks of carmine, so that the general effect was that of a brilliant carmine. Tentacles of a beautiful translucent pink, sometimes uniform throughout, in other cases deepening somewhat in tone at the tips and also at about the middle, where an indistinct band occurred. At the base each tentacle was surrounded by a pair of deeper pink streaks, which were prolonged some distance upon the disc. Oral disc pink in colour, peristome dotted and streaked with crimson, gonidial angles flesh-coloured (Mc. Murrich). Column red, oral disc pale, tentacles chestnut-brown with pale apex. Column orange-red (spec. from Recherche bay). Pale red or reddish yellow (Römer & Schaudinn St. 46).

Dimensions: The largest examined specimens (from the Kara Sea) was about 3,5 cm high and 8 cm broad at the base.

Occurrence: North America. New Foundland 46°5′ N. 51°44′ W., 45°5′ N. 51°49′ W. 56 fms. 45°53′ N. 51°56′ W., 46°6′ N. 52°3′ W. 46—50 fms. (Ingegerd & Gladan-Exp.). George's Bank 42°23′ N. 60°23′ W. 141 fms. (Albatross-Exp. 1883). Eastport, Maine.

West-Greenland. Upernivik (Kraul 1909); Sakrak Vaigattet (Traustedt 1892). Discofiord Middlefiord 100—200 fms. (Ingegerd & Gladan-Exp.). 69°29′ N. 55°26′ W. 116 fms. (Tjalfe-Exp. St. 179 1908). Jacobshavn (Ryder 1892). Claushavn 20 fms. Fortune bay 12—25 fms. (Öberg 1870). Nordre Strømfiord 325—330 m. Bottom temp. — 0,1, Salinity 3°7 (temp. + 3) (Nordmann 1911 St. 3 a). Store Hellefiskebanke (Holm 1887). Holstensborg (Ingegerd & Gladan-Exp. 1871, Holm). Godthaab 100 fms. (Ammondsen). Bredefiord 24—100 m (Rink-Exp. 1912). Kvanefiord 290—400 m, 34—40 m (Rink-Exp. 1912 St. 12, 13). 69°46′ N. 51°22′ W. 250 fms. (Tjalfe-Exp. 1908 $^{27}/_{7}$).

East-Greenland. The sound between Maatten and Renskær 25—30 fms. (Danmark-Exp. 1898). Angmasalik (Søren Nielsen 1901), Locality? (Ryder 1892 $^{16}/_{3}$).

Jan Mayen. 70—90 fms. (Michael Sars-Exp. 1900); 100 m. Bottom temperature —0,4 (Michael Sars-Exp. 1900 St. 25); 55 fms. (Søren Jensen).

Iceland. Berufiord 63°17′,5 N. 17°39′ W. 87 fms. (Beskytteren, Johansen 1905). Vestmannö (Sæmundsson). 64°27′ N. 13°27′ W.

West-Spitzbergen. Low Isl. 16 fms. (Sw. Spitzberg-Exp. 1861); 80° N. 17°5′ E. 40 fms. (Sw. Spitzberg-Exp. 1861). Treurenberg bay 6—30 fms. (Sw. Spitzberg-Exp. 1861). Danish Gat 20—30 m (Wulff 1899). King's bay 200 fms. (Sw. Spitzberg-Exp. 1861), Bell Sound 30—40 fms. (Torell) 3—35 fms. (Sw. Spitzberg-Exp. 1873). Icefiord: Save harbour 20—40 fms. (Malmgren 1864). Entrance to Dickson bay 14—44 m (Sw. Spitzberg-Exp. 1908). Recherche bay 20—30 fms. (Klinckowström), 0—20 m (Sw. Spitzberg-Exp. 1898), off Fox's glacier 75—90 m (Sw. Spitzberg-Exp. 1898), 77°30′ N. 14°36′ E. 30—40 m (Sw. Spitzberg-Exp. 1898).

East-Spitzbergen. Foster Isl. 40 fms. (Sw. Spitzberg-Exp. 1861). Waygat Isl. (Sw. Spitzberg-Exp. 1861). Bismarck strait 78°58′5 N. 20°35′ E. 35 m. Unicorn bay 78°40′ N. 21°31′ E. 60 m (Römer & Schaudinn St. 45, 46). Whales point 20—30 fms. (Malmgren 1864). Devee Bay 12—15 fms. (Kükenthal & Walter). Entrance to Devee bay 77°23′ N. 21°20′ E. 28 m (Römer & Schaudinn St. 8). Wolter Thymen strait 30—40 fms. (Malmgren 1864), 78°14′ N. 21°45′ E. (Römer & Schaudinn St. 47). Ryk-Yse Isl. 77°49′ N. 25°12′ E. 60—80 m (Römer & Schaudinn St. 49). King Charles Land between Jena and Abel Islands 40 m (Römer & Schaudinn St. 32).

North Atlantic. 64°53′ N. 10° E. 600 m. Bottom temp. —0,69° (Michael Sars-Exp. 1910 St. 10).

Norway. Finmark. Kvaenangen (Aurivillius). Ögsfiord 100 m. Bottom temp. 2,1° (Nordgaard). Kvalsund 20 fms. (Sw. Spitzberg-Exp. 1861). Grötsund 70 fms. (Goës & Malmgren). Grötsund Finkroken low-water stand (Sw. Spitzberg-Exp. 1861). Ulfsfiord. Kjösen low-water stand (Sw. Spitzberg-Exp. 1861). Vardö.

Kola peninsula. Ladigino. 66°36′5 N. 41°23′ E. 65 m. Kildin Sound 69°21′ N. 34°5′ E. 86 m (Römer & Schaudinn St. 56, 59). W. of Kolgujew 69°14′ N. 46°39′30 E. 62 m (Andrei Perwoswanny-Exp.). Chewanna 30 fms. (Sandeberg 1877).

Kara Sea. 49 fms. (Dijmphna-Exp.).

Arctic Sea of Siberia. 69°32′ N. 177° 41′ E. (Vega-Exp.). 67°7′ N. 173°24′ W. 9—15 fms. (Vega-Exp.). 2 miles N. of the winter-harbour of the Vega 12 fms. N. N. W. of the winter-harbour of the Vega 12 fms. (Vega-Exp.).

Behring's Sea. Behring Isl. 65—75 fms. (Vega-Exp.); 65°14′ N. 168°35′ W. 29 fms. (Vega-Exp.); 62°39′ N. 177°5′ W. 55 fms. (Vega-Exp.)

Further distribution: Arctic America to Cape Cod (teste Verrill. This statement needs confirmation). George's and Brown's Banks (teste Verrill). Passammoqvoddy Bay (teste Mc. Murrich). Grand Menan (teste Stimpson). Labrador (teste Packard). Murman Sea 79°5′ N. 61°23′ E. 203 m (teste Marenzeller)? Olenja Guba. ?Pala Guba (teste Pax).

This form, "the true *Urticina crassicornis* of the north" (Verrill 1868 p. 470) has undoubtedly been described by Mc. Murrich 1911. I have not much to add to the description given by Mc. Murrich. The column of all specimens was smooth without verrucae. Only in one specimen (from Recherche Bay) the column was provided with spots, recalling contracted verrucae. A nearer examination of these formations, however, showed that they were not verrucae but probably only pigment spots. Like Mc. Murrich I have found that the longitudinal muscles of the tentacles are sometimes ectodermal. In a small specimen, examined by myself, the longitudinal muscles of the tentacles, as well as the radial muscles of the oral disc, were ectodermal. The greatest number of the tentacles was about 160, that of the pairs of mesenteries 83 (in a specimen from the Tjalfe-Expedition). The number of mesenteries was sometimes different in both sides of the directive plane (compare the table). Concerning the distribution of the reproductive organs I cannot decide whether the same mesenteries as in *U. felina coriacea* are fertile. In a specimen from Greenland there are probably 10 primary pairs of mesenteries sterile. Commonly the 20 first pairs are sterile, in the specimen with 83 pairs of mesenteries the reproductive organs were probably present only on the mesenteries of the fourth cycle (compare Mc. Murrich 1911 p. 73). Thus it is probable that the generating region moves during the lifetime of the animal as in *U. felina coriacea.* In many specimens there were numerous embryos in the coelenteric cavity.

The following table shows the size of the spirocysts and nematocysts in a series of specimens, and also some other statements.

Habitat	Tentacles nematocysts		Tentacles spirocysts	Actinopharynx nematocysts	Pairs of mesenteries	Number of tentacles	Distribution of the reproductive organs	Embryos in the coelenteric cavity
Eastport	24—29×2 μ	12—17×1 μ	...	65—74×5 μ	20×22	..	...	+ (present)
»	24—31×2-2,5	..	...	58—84×5	..	..	...	..
»	24—28×2	..	...	60—77	..	..	...	..
New Foundland	26—31×2(2,5)	..	to 55×2,5 μ	72—84×6-7	..	..	...	..
Greenland (without distinct locality).	26—29×2	12—14×1	22×1—48×2	66—82×5	20 ?	..	♀10? primary sterile	o
» »	26—29(34)×2	..	...	62—72×5-5,5	..	110	no reprod. org. (small spec.)	o
» »	24—26×2,5	..	...	50—65×5	..	..		o
» (Tjalfe-Exp. 250 fms.)...........	26—31×2	..	19×1,5—53×2,5	60—72×5	40×43	..	probably only on the mesenteries of the last cycle.	o
» Kvanefiord	22—29×2-2,5	..	...	53—65×5	36×?	..		o
» » (290—320 m).	22—26×2,5	..	—55×2,5	53—67×5-5,5	..	..		..
» Angmasalik.....	...	..	...	53—77×5	..	..		+
» Claushavn (young, height 0,15 cm, breadth 0,3 cm .	17—22×1,5	..	...	43—48×4-4,5	..	..	no reprod. org.	
» Hellefiskebanke .	22-29(31)×2-2,5	..	...	60—72×5	..	..		+
» (Nordm. St. 3 a)	24—29×2	14×1	...	65—79×5	..	..		..
» »	26—29×2-2,5	..	...	67—79×5	20×18	..	♀ 10×10 ster.	o
» 62°29′N 55°26′W.	22—26×2,5	..	22×1,5—43×2,5	62—70×5-5,5	..	..		..
N.E. Greenland Renskær	...	..	...	55—67×5-5,5	..	..		..
Jan Mayen..........	27—31×2	..	...	65—73×5	..	..		+
»	24—31×2-2,5	17×1,5	22×1—53×2,5	62—77×5-6	..	..		..
Iceland Berufiord	22—24×2	..	—43×2,5	60—70×4,5-5	..	..		+
64°27′ N 13°27′ W ...	27—34×2	..	...	79—86×6	..	..		..
Spitzbergen (Leiotealia spetsberg.) ..	24—29×2	..	22×1—48×2,5	55—70×4,5-5,5	..	..		..
» Recherche bay..	27—31×2	12—14×1	—46×2	65—82×4,5-5,5	20×21	82		o
Kola peninsula (Chewanna)	24—29×2	..	...	60—70×5-6	..	..		..
Kara Sea	29—31×2,5	14—17×1,5	...	65—84×5-5,5	40×?	150—160	♀ 10×10 ster.	o
»	27—33×2,5	..	24×1,5—60×2-2,5	67—84×4,5-5	42×?	about 160	♀ 10×10 ster.	o
»	26—34×(2)2,5	...	24×1,5—58×2-2,5	67—82×4,5-5	40×?	..		o
»	22—29×2	..	...	58—72×5	..	..		..
»	...	..	...	60—72×5	..	..		..
» (very large specimen) ..	—36×2,5	..	—65×2,5	77—91×5,6	40×40	..	10×10 sterile.	..
2 miles N of the winter-harbour of the Vega	24—29×2-2,5	..	...	58—70×5	..	..		..
62°39′ N 177,5° W...	24—31×2,5	..	...	65—74×4,5-5,5	38	80		+
Norway. North Cape (small spec.)	19—25×1,5-2	..	—41×2,5	50—60×4,5-5	..	..		+
Norway Finmark	...	..	...	60—72×5	..	..		+
» Vardö..........	24—26×2	..	...	67—77×5-6	..	..		..

Urticina felina crassicornis × Cribrinopsis (or Cribrina)?

Dimensions in strongly contracted state: height 2,2 cm, largest breadth 5 cm.

Occurrence: Greenland without distinct locality, 1 sp.

In a bottle, containing, among others, *Urticina felina crassicornis* and *Cribrinopsis similis*, I found a specimen, which I must for the present consider as a hybrid between these two nearly allied genera, or possibly between *Urticina* and *Cribrina*. In most characters it agrees with *Urticina felina crassicornis*. The column was devoid of sucking warts. The nematocysts in the ectoderm of the tentacles were 25—31 × (2) 2,5 μ, in the actinopharynx 58—67 × 5 μ. The spirocysts of the tentacles variated from 22 × 1—1,5 μ to 48 × 2,5 μ. The longitudinal muscles of the tentacles and the radial muscles of the oral disc were of the same appearance as in *Urticina*. The sphincter was palmate (without a distinct main lamella). The pairs of mesenteries were 10 + 10 + 16 = 36. Among the pairs of the last cycle two on each side of the directive plane were not developed. On one side the pairs 1 and 9 were wanting, on the other the pairs 8 and 9. In the lower part of the actinopharynx 10 pairs were perfect, more distally 20 pairs; the mesenteries of the last cycle almost reached the actinopharynx. In the coelenteric cavity there were numerous embryos. The mesenteries contained numerous small eggs and such were present also on the mesenteries of the first and second cycles, which I have verified also on sections. The distribution of the reproductive organs thus agrees with that in *Cribrinopsis* and *Cribrina*, but not with that in *Urticina*. In this last genus the first 10, or in very large specimens the 20 oldest pairs namely commonly are sterile; in small specimens of *U. felina coriacea* I have found only the six first pairs to be without reproductive organs (compare *Urticina felina coriacea*). As the specimen was comparatively large, I think that it is difficult to consider it as a pure *Urticina*. An *Urticina* of the same size as our specimen has namely at least the 10 first pairs of mesenteries sterile. It is true that in certain genera, as in *Urticina*, a displacement in the appearance of the reproductive organs takes place, so that with the increasing age of the animal a cycle of mesenteries, which was fertile in young individuals, becomes sterile in older ones, in other words, the reproductive organs appear in older individuals in a later cycle than in younger ones, but I have never observed that a species beginning by developing the reproductive organs on the mesenteries of the first cycle afterwards loses this capacity, so that in a later reproductive period the fertility appears first on the mesenteries of the second cycle. I also think that a hybridisation between *Urticina* and *Cribrina* or *Cribinopsis* may be admitted, as the species occur together (compare p. 156).

Genus **Epiactis** Verr.

Diagnosis: Cribrinidae with smooth column, without warts, acrorhagi and pseudoacrorhagi. Column with (or without?) a cuticle. Tentacles simple, cylindrical or conical, short. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. Mesenteries hexamerously arranged (always?). Reproductive organs found on the mesenteries of the first cycle and on the other stronger mesenteries.

The diagnosis given by Stephenson (1918 a p. 24) of the genus is too comprehensive, as, according to that formation, the genus *Isotealia*, as well as *Urticina felina crassicornis*, and possibly certain specimens of *Cribrinopsis similis*, may be arranged into the genus. Therefore I have set up a new, somewhat more distinct diagnosis, by which also the genus *Pseudophellia* Verr. may be included (compare p. 145—146). Concerning the species placed by Stephenson with *Epiactis*, the systematic position of some of them is questionable, and *E. fecunda, dubia, badia* and *nymphaea* are only provisionally to be referred to *Epiactis*. According to me, *E.* (*Leiotealia*) *spetsbergensis* must be dropped, as this species includes at least two, possibly a few more, species, belonging to different genera. I have before put forth, that *L. spetsbergensis* perhaps for the greater part is an *Urticina felina crassicornis*. Sections through the tentacles of some specimens and a closer examination of part of a specimen clearly show that we have to do with this species. The longitudinal muscles of the tentacles were namely principally mesogloeal, the distal end of the primary folds are fused together, so that a thin band of mesogloea is formed next to the ectoderm (the sections recall the figure 4 Pl. 2, given by Mc. Murrich 1911). The nematocysts also agree with those of *Urticina*. The description, given by Kwietniewski, of a specimen — or maybe compiled from several specimens — indicates that the species is heterogeneous, which I am able to confirm after having examined another specimen. This specimen possibly may be a *Cribrina spetsbergensis*, though the sucking warts seem to be absent (compare this species p. 155). I have before (1901 p. 43) suggested, that *Leiotealia* might be identical with *Epiactis*(?) *fecunda* — an opinion, which I based principally on the presence of a broodroom in a specimen of Kwietniewski's species, and on the absence of sucking warts. This suggestion however, requires, confirmation. On all accounts, Kwietniewski's species contains at least two species, belonging to two different genera. Under such circumstances I prefer to abolish *Leiotealia spetsbergensis*.

Among the Arctic Cribrinids I have found 4 species: *Epiactis marsupialis* Carlgr., *E. arctica* (Verr.), *E. nordmanni* n. sp. and *E. incerta* n. sp.

Epiactis marsupialis Carlgr.

Epiactis marsupialis n. sp. Carlgren 1901 p. 482.

Diagnosis: Column in contracted state generally conical, the height often twice the diameter of the body. Column with a slightly developed cuticle; with distinct fossa. Sphincter generally of palmate type, strong. Tentacles conical, not or slightly longitudinally furrowed, in number to about 48 (6+6+12+24). Gonidial tubercles distinct. Actinopharynx long with about 24 longitudinal furrows and two well developed siphonoglyphes with rather well developed aboral prolongations. Mesenteries in three cycles (6 + 6 + 12 pairs), often more numerous than the tentacles, most of them perfect. Longitudinal muscles of the mesenteries well developed, broad. Parieto-basilar muscles very strong, reaching at most to the sphincter. Basilar muscles rather strong. Oral and sometimes marginal stomata present. Dioecious. 6 symmetrically placed pairs of the last cycle smaller than the others of the same cycle, without reproductive organs and mostly without filaments. The embryos develop in excavated pits on the outside of the aboral part of the column. Nematocysts in the ectoderm of the column 22—32 × 2,5—3 μ, in the tentacles 18—26 × about 2 (1,5—2,5) μ, in the actinopharynx 24—34(35) × 3—4,5 μ. Spirocysts of the tentacles from (14) 17 × 1—31 × 2,5 μ.

Colour in alcohol: Tentacles pale rose-red (1 spec.). The ectoderm of the column was brownish.

Dimensions: The strongly contracted, in 1901 reproduced specimen, furnished with brood-pits, had a length of 1,8 cm, its largest breadth was 2,2 cm. Two other specimens were 3 cm resp. 1,4 long and 1,7 cm resp. 0,7 cm broad.

Occurrence: Arctic sea of Sibiria. 20° E. off Cape Jakan 12 fms. Sand and clay with stones (Vega-Exp.), 67°7′ N. 173°24′ W. 9—15 fms. mud and stones (Vega-Exp.), 2 miles N. of the winter station of the Vega 12 fms. sand (Vega-Exp.).

Exterior aspect. The column was in contracted state generally conical, its length was often twice its breadth; the single specimen with extended tentacles was elongated, cylindrical. The pedal disc was as a rule a little involved and radially sulcated. The column was quite smooth in some expanded specimens, in others furnished with longitudinal and transversal ridges, and devoid of sucking warts, acrorhagi and pseudoacrorhagi. Its ectoderm is furnished with a weak cuticle, sometimes a little incrusted, and which seems easily deciduous (compare below). In three specimens (from Cape Jakan) there are brood-rooms developed in the lower part of the column (compare Carlgren 1901), in the other specimens, among which there were some females, no brood-rooms appear. The fossa is distinct. The tentacles were short, strongly contracted and conical, about as long as broad, in one specimen more elongated, the outer tentacles a little shorter than the inner ones. Their surface was in preserved state smooth or weakly sulcated. They were hexamerously arranged, and the number in the examined species variates between 35 and 47 (35, 36, 41, 41, 43, 43, 44, 45, 47). The number of the tentacles was, as a rule, smaller than that of the mesenteries, in other words, the mesenteries grow forth from below upwards. The actinopharynx was long and furnished with about 24 longitudinal furrows and ridges. The 2 symmetrically placed siphonoglyphes were broad, in the upper part with 2 distinct gonidial tubercles, aborally a little prolongated.

Anatomical description. The ectoderm of the column is high and contains numerous nematocysts like that of the tentacles and the actinopharynx. The nematocysts of the column are longer and a little broader than those of the tentacles, as the following table shows.

	column nematocysts	tentacles nematocysts	tentacles spirocysts	actinopharynx nematocysts
Sp. 1. from Cape Jakan	24—31 × 2,5—3 μ	19—22 × 2(2,5) μ	14 × 1—26 × 2 μ	26—34 × 3—3,5 μ
- 2. — — —	—	22—26 × 2	17 × 1—29 × 2	26—34 × 3—3,5
- 3. — — —	—	18—24 × (1,5) 2	17 × 1—27 × 2	26—34 × 3—3,5
- 4. — — —	26—31 × 2,5—3	19—24 × 2—2,5	19 × 1—31 × 2	24—31 × 3,5—4,5
- 5. — — —	24—31 × 2,5	20—23 × 2	—26 × 2	26—34 × 3—3,5
- 6. — — —	—	19—23 × 2	—	—
- 7. — 67°2′ N.	—	19—24 × 1,5—2	17 × 1—29 × 2,5	24—34 × (2,5)—3,5
- 8. — —	26—32 × 2,5	19—25 × 1,5—2	17 × 1—28 × 2,5	25—32 × 3—3,5
- 9. — the winter station of Vega	22—29 × 2,5	19—22 × 1,5	—	—
- 10. — — —	—	(17)19—22 × 1,5—2	—	26—35 × 3—3,5

The homogeneous gland-cells of the column are very numerous, the granulous gland-cells fewer. The ectoderm of the column is furnished with a weak, easily deciduous cuticle. In some specimens it is lost, in the type-specimens there were fragment of a cuticle incrusted with foreign bodies; the cuticle appears most distinctly in the brood-rooms, from where it was not easily rubbed off. The mesogloea is rather thick and contains small protoplasma-poor cells. The endodermal circular muscles were very well-developed and the folds of the muscle layer ramificated. The sphincter was strong, of palmate type; in one examined specimen the sphincter was proximally furnished with a main lamella which, however, soon became branched (textfig. 178, transverse section of the sphincter), in another specimen there was no main lamella in the sphincter. The longitudinal muscles of the tentacles and the radial muscles of the oral disc are ectodermal, but the folds are rather low and only take up a small part of the height of the ectoderm. The folds are arranged like palisades, and at the insertions of the mesenteries on the oral disc considerably weaker and not as closely packed as in the middle parts. The ectoderm of the actinopharynx is very high in the ridges, in the furrows considerably lower.

Textfig. 178. *Epiactis marsupialis*. Transverse section of sphincter.

The mesenteries were in 5 examined specimens 48 (6 + 6 + 12 pairs). The pairs of the third cycle were unequally developed. 6 pairs were strong, perfect and had well-developed reproductive organs and filaments, the other 6 pairs were weak, imperfect, in certain cases not reaching to the tentacular region, were devoid of reproductive organs and generally also of filaments. The six weaker pairs were in all specimens likewise arranged. If we use numbers to designate the different cycles of mesenteries and begin with the one directive pair (*dm*), the weaker pairs (designated by spaced out figures) were grouped in the following manner:

1 (dm) 3 2 **3** 1 3 2 **3** 1 3 2 **3** 1 (dm) 3 2 3 1 **3** 2 3 1 **3** 2 3

In the largest specimen (with 47 tentacles) the weaker pairs of the third cycle were in the distal part furnished with small filaments. Therefore it is possible that these mesenteries in still older specimens obtain longer filaments and perhaps also reproductive organs. All the stronger mesenteries were perfect. The mesenteries of the first cycle were coalesced with the actinopharynx to a larger extent than the mesenteries of the second order, the mesenteries of the third cycle were the least expanded on the actinopharynx. The longitudinal muscles form rather strong pennons with folds of about equal height. The parieto-basilar muscles were very broad in the proximal part and almost reach the sphincter. Oral stomata and sometimes marginal stomata were present, probably the latter are not permanent. The species is dioecious. All the stronger mesenteries are fertile. The ova are very large and rich in yolk. Of 9 examined specimens 3 were males and 6 females, 3 of the latter were furnished with brood-rooms.

Epiactis arctica (Verr.).

Pl. 3, Figs. 8—10. Pl. 4, Fig. 9.

Phellia arctica n. sp. Verrill 1868 p. 328. 1868 p. 490. Andres 1883 p. 342.
Pseudophellia arctica Verr. Verrill 1899 p. 376 textfig. 34.

Diagnosis: Column elongated, covered with a well-developed but easily deciduous cuticle, and sprinkled with spots of special structure. Fossa distinct. Sphincter of palmate or palmate-pinnate type. Tentacles conical, not or slightly longitudinally furrowed, in numbers from 31—38 (6+6+12+ an imperfect 4th cycle). Gonidial tubercles distinct. Actinopharynx long with at least 24 longitudinal ridges and two well-developed siphonoglyphes with no aboral prolongations or with short ones. Mesenteries in those cycles (6 + 6 + 12 pairs) more numerous than the tentacles. Longitudinal muscle-pennons rather strong, broad. Parieto-basilar muscles very strong almost reaching the sphincter. Oral stomata but no marginal stomata. Dioecious. 6 symmetrically placed pairs of the mesenteries of the last cycle without filaments and reproductive organs. The embryos develop in excavated pits on the outside of the aboral part of the column. Nematocysts in the ectoderm of the column 29—37 × 2,5—3 μ, in the tentacles 24—30 × 2—2,5 μ, in the actinopharynx (26)29—36 × 3—3,5 μ. Spirocysts of the tentacles 19 × 1 μ to 34 × 2,5 μ.

Colour in alcohol: In a specimen the ectoderm of the column was dark brown especially in the distal part, and sprinkled with small white spots. Another specimen was more light brown, and a third in the distal part dark brown (in the proximal part the ectoderm was lost). The ectoderm of the column in the other specimens was uncoloured, here and there fragments of darker parts (cuticle?) were however present.

Dimensions: A specimen, the column of which was much expanded, measured in height and breadth 3 cm. The largest specimen with involved tentacles and of a cylindrical-conical appearance was 3,4 cm long and 2 cm broad. The smallest specimen with visible tentacles was 2,1 cm long and 0,9 cm broad.

Occurrence: 64°53′ N. 10°0′ W. 630 m. Temp. at 600 m — 0,69 (Michael Sars-Exp. 1900).
Arctic ocean north of Behring's strait 30 fms. (North Pac. expl.-Exp.—teste Verrill).

Exterior aspect. Of the 10 specimens three were comparatively slightly contracted. Their column was cylindrical and their tentacles unfolded. Four specimens were strongly expanded, their breadth and height about equal, the form of the others was like a drawn-out cone. The pedal disc was well-developed. The column was in the contracted specimen often a little longitudinally wrinkled. In a specimen, the colour of which was the best preserved, there were small, light, irregularly scattered spots, the largest spots appeared in the distal part, though also there they were almost inconspicuous to the naked eye; the smallest spots, scattered between the larger, and especially very numerous in the lower part of the column, were only conspicuous under strong magnifying powers. Traces of such spots were present also in another specimen. Some of the others show fragments of a thick cuticle (compare below). Near the base of an expanded specimen there were several large circular spots reaching those I have observed in a specimen of *E. marsupialis*. In this species the spots were certainly marks of embryos, having evidently passed some time upon the parent after emigrating from their brood-rooms. From this I conclude that also this specimen of *E. arctica* has been furnished with brood-rooms. The fossa was distinct. The tentacles were conically drawn out, between 31 and 38 in number, hexamerously arranged, the last cycle was imperfect. Commonly they were smooth, sometimes a little longitudinally sulcated. The number of the tentacles was smaller than that of the mesenteries. The actinopharynx was long and furnished with at least 24 longitudinal ridges, sometimes more. The two symmetrically placed siphonoglyphes show distinct gonidial tubercles, I am not able to find any perspicuous aboral prolongations.

Anatomical description: The ectoderm of the column is high and contains very numerous nematocysts, which are longer than those of the actinopharynx. Their size variates between 29—37 × 2,5-3 μ. In a specimen I found a capsule, 43 × 4,5 μ in size. The above named small spots on the column of the best preserved specimen display another structure than the other parts of the body-wall. They are built up mainly of supporting cells (Pl. 4 fig. 9), here and there a granulous gland cell was observed; on the other hand, there were no nematocysts, excepting in the rim of the spots, where they are, however, very rare. In the other part of the columnar ectoderm, the nematocysts, as well as the gland cells, were numerous. Of the gland cells some, the fewer, were more homogeneous, the others, the more numerous, contained a multitude of small brownish granulae. Whether the latter, which often reach a considerable size, are gland-cells of the same kind as the former, but in a different state of secretion, I cannot with certainty decide. Possibly the circumstance that I have not observed any such in the unpigmented specimens, speaks in favour of this suggestion, though I hardly believe this to be the case. In the unpigmented specimens the homogeneous gland-cells were, however, numerous, but the ectoderm of these specimens was not as well preserved as in the specimens with spots. As above mentioned, there were in some specimens fragments of a cuticle which is evidently easily deciduous. The cuticle seems to be very thick but incompact and cracked, and not of typical appearance. The mesogloea of the column is thick and contains rather sparse protoplasma-poor cells. The endodermal circular muscles are very well developed and form high, delicate, ramificated folds; in the region of the sphincter the muscle layer is weaker. The sphincter is strong and of a somewhat variable type. In a specimen it was on transverse sections round and distinctly palmate without a main lamella, and with a tendency (on some sections) to form meshes, in two other specimens it was compressed and of variable structure in different sections of the same specimen, now there was no distinct main lamella but rather several longitudinal lamellae in the middle of the sphincter, now these latter were fusing in the middle part, or finally the sphincter was almost palmate. If a main lamella was present, it was always more weakly developed at the base than in the middle part (textfig. 179 from the specimen with spots). The ectoderm of the tentacles was very high with numerous nematocysts 24—30 × 2 (2,5) μ and numerous spirocysts, 19 × 1 μ to 34 × 2,5 μ in size. The longitudinal muscles of the tentacles (textfig. 180 transverse section of a part of tentacle from Michael Sars-Exp. St. 10) were ectodermal with rather high folds, in transverse sections often of a palisade-shaped appearance. In the apex the folds were often a little branched. The structure of the radial muscles in the oral disc is the same as that of the longitudinal muscles of the tentacles; the folds were, however, lower here, and so was the ectoderm. The ectoderm of the actinopharynx was, in the ridges, very high and contained very closely packed nematocysts, (26)29—36 × 3—3,5 μ in size, in the furrows considerably lower and with sparser nematocysts. The size of the nematocysts and spirocysts in four specimens was as follows (p. 181).

Fig. 179

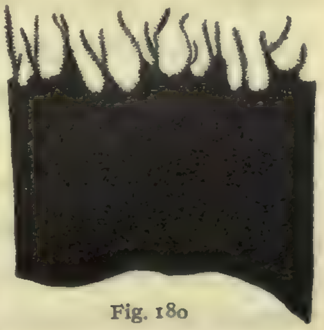


Fig. 180

Textfigs. 179—180.
Epiactis arctica.
Transverse section of sphincter (fig. 179) and of part of a tentacle (fig. 180).

The pairs of mesenteries were in 5 examined specimens 24 (6 + 6 + 12). The mesenteries of the third cycle showed the same differentiation as in *E. marsupialis*, in as much as half the pairs had reproductive

Size of the body	Nematocysts of the column	Tentacles nematocysts	Tentacles spirocysts	Nematocysts of the actinopharynx	Number of tentacles
Sp. 1. length 2,7 cm, breadth 1,7 cm ..	31—37×2,5—3 μ	25—30×2—2,5 μ	19×1—32×2,5 μ	29—36×3,5 μ	—
- 2. — 3 - — 3 - ..	29—36×2,5—3	26—30×2	19×1—31×2,5	(26)29—35×3—3,5	36
- 3. — 2,1 - — 0,9 - ..	31—37×2,5—3	24—27×2	19×1—34×2,5	31—36×3—3,5	31
- 4. — 3,1 - — 1,7 - ..	30—36×2,5—3	24—30×2	19×1—34×2,5	29—34×3—3,5	38

organs and filaments, the other half none. The latter occupied the same place as in *E. marsupialis*. The mesenteries with filaments commonly were perfect, the mesenteries of the third cycle, however, did not always reach the actinopharynx, which may be concluded from the number of tentacles. The longitudinal pennons commonly were broad with palisade-shaped, rather high folds. The parietobasilar and the basilar muscles were like those of *E. marsupialis*. Oral stomata were present; I have not observed any marginal stomata. Three examined specimens were females, two males.

The above description is based on the material from the expedition of "Michael Sars".

Systematic remarks. I have, though with some hesitation, identified this species with Verrill's *Pseudophellia arctica*, especially on account of Verrill's description of the cuticle ("thick and soft") and the presence of brood-rooms in the proximal part of the body. Verrill, however, declares that his species has a greater number of mesenteries ("24 perfect pairs with a few imperfect ones"). Still Verrill's description is rather imperfect. A control examination of the mesenteries, as well as a study of the nematocysts, are necessary, to decide whether Verrill's species is identical with the species, described here.

The species is very nearly allied to *E. marsupialis*, and I was at first inclined to place them together. On account of the different appearance of the cuticle in both species, in *marsupialis* it is thin and solid, in *arctica* thick and soft, and of the greater length of the nematocysts in the column in *arctica*, I think that they are not identical. The above named nematocysts of *E. arctica* are namely also in small specimens shorter than those of *E. marsupialis*. Also in some other characters the species seem to disagree. The species described below is also nearly related to both these species, from which it differs by a regular development of the mesenteries of the third cycle.

Epiactis nordmanni n. sp.

Diagnosis: Column in contracted state conical, in height surpassing the diameter of the body. Column without a cuticle(?). Fossa distinct. Sphincter palmate. Tentacles conical, rather small, not or slightly longitudinally sulcated, 48 in number, hexamerously arranged. Actinopharynx long, with about 24 longitudinal ridges and two well developed siphonoglyphes with distinct gonidial tubercles. but without aboral prolongations. Pairs of mesenteries 24, all perfect in three cycles. Longitudinal muscle pennons of the mesenteries rather strong, broad, the muscle folds of uniform breadth. Parietobasilar muscles strong, almost reaching the sphincter. Oral stomata present but no marginal stomata. Dioecious. All mesenteries with reproductive organs and filaments. Nematocysts in the ectoderm of the column 26—31 × 2,5 μ, in the tentacles 22—26×2 μ, in the actinopharynx 31—36×3—3,5 μ. Spirocysts of the tentacles 19×1—24 × 1,5 μ.

Colour in alcohol: Column olive-brown, tentacles pale salmon-coloured.

Dimensions: Length of the column 2,2 cm, largest breadth 1,2 cm. Length of the tentacles about 0,4 cm.

Occurrence: Greenland. Nordre Strømfjord, 325—330 m. Temperature at the bottom — 0,1° (Nordmann 1911 St. 3 a) 1 sp.

Exterior aspect: The form of the body is the same as in the former species. The single specimen was a little contracted, one part of the tentacles was however conspicuous. The column was a little longitudinally wrinkled, the fossa was deep. The tentacles were 48, hexamerously arranged, as many as the mesenteries, and all of about equal length, the inner, however, thicker, conical. Their surface was smooth or indistinctly longitudinally sulcated. The oral disc was inconsiderable, the actinopharynx long with distinct siphonoglyphes, having well developed gonidial tubercles, but no aboral prolongations.

Anatomical description. The ectoderm of the column is rather high and contains numerous nematocysts, finely-grained gland-cells and sparser mucus-cells. Concerning the size of the nematocysts and spirocysts, compare above. I have not observed any cuticle, nor any of the spots on the column, which are present in *E. arctica*. The mesogloea is thicker than the ectoderm, the endodermal circular muscles strong, and recall those of the former species. The sphincter is palmate and much recalls the reproduced sphincter of *E. arctica* but is devoid of a main lamella and, on account of the contraction, a little compressed. The longitudinal muscles of the tentacles and the radial muscles of the oral disc agree with those of the former species.

The pairs of mesenteries are 48 in number (6 + 6 + 12). All the mesenteries of the third cycle were of about the same size and had well-developed filaments and reproductive organs. All mesenteries are perfect. The longitudinal pennons were somewhat broad, with rather high folds, all of about the same length. The parieto basilar and basilar muscles are not different from those of *E. arctica*. The specimen was a male, with well developed reproductive organs.

Systematic remarks. The species is distinguished from *E. marsupialis* and *arctica* by the consistency of the column, and by all the mesenteries of the third cycle being equally developed. The tentacles are also a little more numerous, and the size of the nematocysts of the column differing from that of *E. arctica*. As the specimen was considerably smaller than the larger specimens of *E. arctica* and *marsupialis*, but nevertheless had all the mesenteries of the third cycle equally developed and furnished with filaments and reproductive organs, I think that it may be a particular species. It is most nearly allied to *E. marsupialis*.

Epiactis incerta n. sp.

Diagnosis: Column not elongated, without a cuticle and particularly differentiated spots. Fossa distinct. Sphincter strong, palmate. Tentacles from conical to cylindrical, rather broad, smooth, 28 in number. Actinopharynx sulcated with two siphonoglyphes. Pairs of mesenteries 14 $(6+4+4;\ \overset{dm}{1}321321\overset{dm}{1}123123)$. Longitudinal muscle pennons very strong with high and concentrated folds. Parieto-basilar muscles very strong, almost reaching the sphincter. Oral stomata and marginal stomata present. Dioecious. Nematocysts in the ectoderm of the column 24—31 $\times$ 2—2,5 μ, in the tentacles 22—26 $\times$ 2 μ (also smaller 15—17 $\times$ 1,5 μ), in the actinopharynx 36—46 $\times$ 3,5—4,5 μ. Spirocysts of the tentacles 19 $\times$ 1,5—36 $\times$ 2 μ.

Colour?

Dimensions in contracted state: length and breadth about 2,2 cm.

Occurrence: 20′ E. off Cape Jakan 12 fms. Sand and clay with stones (Vega-Exp.) 1 sp. Together with *E. marsupialis.*

Exterior aspect. The pedal disc is well developed and the column smooth, without spots. The fossa is deep, the tentacles from conical to cylindrical, smooth and rather thick, in number probably as many as the mesenteries. Only about 20 tentacles were, however, perspicuous, but as I have observed some involved tentacles in the weakest compartments, I think that the number of tentacles and mesenteries is the same. Concerning the appearance of the actinopharynx I cannot give any perfect informations, as it was very contracted and badly preserved, and partly in a mess with the reproductive organs. It is, however, distinctly longitudinally sulcated.

Anatomical description: The ectoderm of the column is high and contains numerous mucus-cells and nematocysts (size compare the diagnosis). The mesogloea is thick, and the endodermal circular muscles much weaker than those of the former species. The sphincter is of a decidedly palmate type (textfig. 182), on transverse sections round and well-developed. The ectoderm of the tentacles is high, the nematocysts and the spirocysts (compare the diagnosis) numerous. Their longitudinal muscles (textfig. 181) are strong, and recall those of *Cribrina spetsbergensis,* but are ectodermal; there is but rarely a mesogloeal mesh at the base of the muscle folds. The radial muscles of the oral disc are weaker, especially at the insertions of the mesenteries. Here the muscles seem to show a tendency to become mesogloeal, whereas they are ectodermal between the mesenteries. The nematocysts of the actinopharynx are numerous (size compare above). The ectoderm and also the endoderm of the siphonoglyphes are very high, an ectodermal longitudinal muscle layer is present.

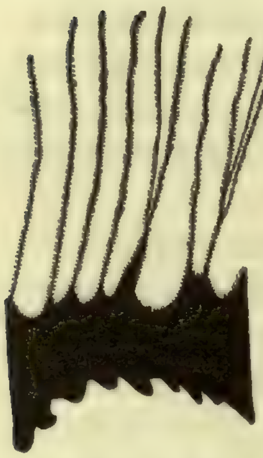


Fig. 181

Fig. 182

Textfigs. 181, 182. *Epiactis incerta.* Transverse sections of part of a tentacle (fig. 181) and of the sphincter (fig. 182).

The mesenteries are hexamerously arranged, though even at the origin of the second cycle the development of certain pairs of mesenteries is checked. If we mark with figures the different cycles of mesenteries and begin with the one directive pair (*dm*), the arrangement is the following.

$$\overset{dm}{1}\ 3\ 2\ 1\ 3\ 2\ 1\ \overset{dm}{1}\ 1\ 2\ 3\ 1\ 2\ 3 = 14 \text{ pairs } (6+4+4).$$

The pairs thus were equally checked on both sides of the directive plane. In two primary exocoels, one on each side of the one directive pair, there are no mesenteries of the second and third cycles, and in the other primary exocoels the mesenteries of the third cycle are present only in the exocoels of the second order next to the other directive pair. Supposing that the mesenteries are developed according to the same rule as in *Urticina*, the ventro-lateral mesenteries of the second cycle are absent, and among the mesenteries of the third cycle only the dorsal pairs in the primary dorso-lateral and lateral compartments are developed. All mesenteries seem to be perfect; possibly one or other pair of the third cycle may be imperfect, but I cannot decide this, because of the bad preservation of the specimen. The longitudinal muscle pennons are strong, the folds are very high and palisade-shaped, the main folds often have small secondary folds, issuing from both sides. The parietobasilar muscles are strong and recall those of the former species. Oral and marginal stomata are present, though not large. The single specimen was a female with numerous, very large ova. The mesenteries of the first and second order incl. the directives were fertile, on the microscopically examined mesenteries of the third cycle I have not observed any reproductive organs. All mesenteries are furnished with filaments, most weakly developed on the mesenteries of the third cycle.

Systematic remarks. This species is most nearly related to *E. marsupialis* and *arctica*, because of the arrangement of the mesenteries. I think that it is a distinct species, as also the nematocysts of the actinopharynx differ from those of the former species.

Fam. *Paractiidae*.

Diagnosis: Basilaria with a commonly smooth, rarely tuberculated column, which is devoid of sucking warts (present in "*Tealidium*" *cinctum*?) and acrorhagi. Sphincter weak or strong, always mesogloeal. Tentacles commonly short, on the outside of the base often bulbous, sometimes (in *Anthosactis* and *Tealidium*) with a stinging battery in the same place. Mesenteries now typically arranged, but sometimes after another cardinal number than 6, with both mesenteries in the same pair of the younger cycles either equivalent or differently developed, now arisen bilaterally only in 12 exocoels, when the 24-mesenteries stadium has been reached. Always without acontia.

The following genera have been placed in this family by various authors:

Actinernus Verr.	*Aulorchis* R. Hertw.	*Paractinia* Andr.
Actinostola Verr.	*Cymbactis* Mc. Murr.	*Paractis* M. Edw.
Alloactis Verr.	*Hormosoma* Steph.	*Paranthus* Andr.
Ammophilactis Verr.	*Kadosactis* Dan.	*Parantheoides* Carlgr.
Antholoba R. Hertw.	*Kyathactis* Dan.	*Phelliomorpha* Carlgr.
Anthosactis Dan.	*Lilliella* Steph.	*Phelliopsis* Verr.
Antiparactis Verr.	*Marsupifer* Carlgr.	*Pycnanthus* Mc. Murr.
Archactis Verr.	*Ophiodiscus* R. Hertw.	*Polysiphonia* R. Hertw.
Raphactis Verr.	*Stomphia* Gosse.	*Tealidium* R. Hertw.
Sicyonis R. Hertw.	*Synanthus* Verr.	

The new genera I have proposed are:

Epiparactis Carlg.	*Parasicyonis* Carlgr.	*Synsicyonis* Carlgr.

Some of the old genera are imperfectly known, some others do not belong to the family, and still others are to be regarded as synonyms. It is, therefore, necessary to discuss the genera more closely.

Actinernus: I have (1918) shown that the type *A. nobilis* Verr. belongs to the Halcuriidae = Endocoelactiidae. For *A. saginatus* (Verr.), *plebeius* (Mc. Murr.) and *aurelia* (Steph.), which are really Paractids, we must establish a new genus[1].

Actinostola (type *A. callosa* Verr.) is a good genus, characterized by various authors and treated also in this paper.

Alloactis (type *A. excavata* (R. Hertw.)) is a synonym for *Anthosactis* and must be dropped (compare *Anthosactis* p. 191).

Ammophilactis (type *A. rapiformis* Les.). The diagnosis, given by Verrill (1899 p. 213), shows that the genus is different from *Paranthus*. "The reduced and feeble base" possibly indicates that the genus does not belong to this family but to the Halcampidae. A closer examination is desirable.

Antholoba (type *A. reticulata* Couthony = *achates* (Drayton)) is a good genus and characterized by Hertwig (1882), Carlgren (1898) and Mc. Murrich (1904).

Anthosactis (type *A. jan mayeni* Dan.) is a distinct genus and easily identified (compare this paper).

Antiparactis (type *A. lineolata* (Dana? Mc. Murr.) = *dubia* n. nom. Verrill (1899 p. 212)). Concerning this genus compare the genus *Pycnanthus* in this work, where a diagnosis of the genus is given.

Archactis Verr. (type *A. perdix* (Verr.)) Verrill has (1899 p. 209) proposed this genus for *Urticina perdix*. I have had the occasion to examine a specimen of this species, which the "Riksmuseum" in Stockholm has received from the United States National Museum, wherefore I can supply the statements of Verrill concerning its organisation. In fact, it agrees very well with Antholoba. The sphincter is reticular and very long in both genera, the longitudinal muscles of the tentacles are weak and ectodermal in *Archactis* as well as in *Antholoba*, in the latter genus with a little tendency to be ecto-mesogloeal in their basal parts. The radial muscles of the disc are of a similar appearance in both genera and are ecto-mesogloeal (I wrote 1898 p. 29 that these muscles are mesogloeal in *Antholoba*, it is more correct to designate them as ecto-mesogloeal). The whole organisation of both species is the same; the appearance of the column, the undulated disc, the numerous small tentacles and mesenteries, of which a great deal are perfect, the muscles of the mesenteries, all agree. I have stated 1898 that the mesenteries of the first to the third orders are sterile in *Antholoba*. As far as I can see, the fertile mesenteries only begin, also in *Archactis*, on the mesenteries of the fourth order (on the other hand Verrill declares that all mesenteries in *A. perdix*, belonging to the first five cycles except the directives, are fertile). Thus I think that *A. perdix* is an *Antholoba*.

The nematocysts of the column of this species were 19—26 × about 2 μ, those of the tentacles partly 14—19 × 1 μ, partly 24—29 × 1,5 μ, partly 29—34 × 2,5 μ, those of the actinopharynx partly 14—17 × 1 (1,5) μ, partly 24—30 × 2,5 μ. The spirocysts of the tentacles were 19 × 1,5 μ to 38 × 2,5 μ.

Aulorchis (type *A. paradoxa* R. Hertw.) belonging, according to Hertwig, to his family Liponemidae. The exterior of this genus, the number and structure of the tentacles (the suppositional weak development of these latter is certainly connected with their being more strongly contracted and more badly preserved than in *Sicyonis crassa*), the structure of the oral disc and the appearance of the siphonoglyphes agree with the corresponding facts in *Sicyonis*. Hertwig has not been able to determine how the mesenteries are grouped,

[1] Stephensen (1920 b p. 540) called this new genus *Actinoscyphia*.

but he adds that he is convinced that they are hexamerously arranged. The peculiarity of this genus should be that "the generative organs are modified into a single tube perforating the oral lip". Hertwig's description of this tube is, however, founded on an examination of bad material and makes the impression that an abnormal formation was present. Though it is difficult to decide its nature on basis of the observations of Hertwig, I will, however, give as my opinion that the genital tube has arisen by regeneration and probably represents an additional actinopharynx, developed in a reproductive region (compare Carlgren 1904 p. 11—12). The whole formation is, however, so peculiar that a closer examination of it is necessary, before Hertwig's statement can be accepted. Disregarding this formation, I think that it is possible to place *Aulorchis* in the vicinity of *Parasicyonis* or *Sicyonis*.

Cymbactis (type *C. faeculenta* Mc. Murr.). The description of the type (Mc. Murrich 1893 p. 174) is in some respects incomplete. Still I think that we have to do with a distinct genus, characterized as follows:

Paractiidae with well developed basal disc and thick crateriform body, with smooth, in contracted state rugose, column which is devoid of tubercles and acrorhagi. Sphincter muscle relatively weak, placed close to the endoderm. Margin tentaculate, not lobed. Tentacles short, acuminate and slender, not bulbous at the base, numerous. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. 2 siphonoglyphes. Mesenteries hexamerously arranged, at least the first 2 cycles perfect. Longitudinal muscles of the mesenteries form no special pennons. Distribution of the reproductive organs? Mesenteries more numerous in the upper part of the column than in the proximal part.—This genus is separated from *Pycnanthus* by a richer development of mesenteries in the distal than in the proximal part, while in *Pycnanthus* it is the opposite. From Mc. Murrich's description of *Cymbactis* we namely may conclude that it is so. Mc. Murrich speaks of the presence of 48 mesenteries (twenty-four pairs) but of 96 tentacles. As in *Actininae* we are not able to suppose a richer development of tentacles than of mesenteries, Mc. Murrich must have overlooked weak mesenteries in the most distal part of the body. Perhaps also the reproductive organs are differently arranged in the two genera. Of the other known *Cymbactis* I have placed *C. actinostoloides* Wassil. and *maxima* Wasill. to *Parasicyonis*, and *C. gossei* Steph. to *Sicyonis* (compare these genera).

Hormosoma (type *H. scotti* Steph.). This seems to be a distinct genus (compare Stephenson 1918 a p. 29). It is easy to give a more complete diagnosis on basis of Stephenson's description.

Kadosactis (type *K. rosea* Dan.). I have examined the single type-specimen. Owing to the bad preservation, especially of the filaments, which were totally macerated, I cannot definitively confirm the real position of this genus. The animal has a very strong sphincter and very strong longitudinal muscle pennons. I am inclined to consider this form as a *Phellia*. I will come back to this genus in the second part of this work.

Kyathactis (type *K. hyalina*) is an *Actinostola* (compare *Actinostola spetsbergensis*).

Lilliella (type *L. lacunifera* Steph.). The position of this genus, proposed by Stephenson (1918 a p. 33) is dubious. The only specimen was namely badly preserved in the inner parts. The whole exterior of the species and the presence of only six perfect mesenteries indicate that the species belongs to the Chondractiniinae, viz. to a family with acontia.

Marsupifer (type *M. valdiviae* Carlgr.) is synonymous with *Halianthella* Kwietn. belonging to the family Halcampidae, and the species probably is the same as *H. kerguelensis* (Stud.). A closer examination of the species has namely proved that the weak basilar muscles, which I supposed to be present, are not such muscles but the undermost part of the parietal muscles. The conclusion in my preliminary report of this genus that it was provided with basilar muscles, was somewhat hastily drawn, as the one species was flattened in the basal end and the other one, the contracted column of which was very low, was with a very broad base attached to a shell. This species thus has the power to considerably alter its basal end from rounded physa-like to a flattened wide basal plate, as it is also the case with *Cactosoma* and *Milne-Edwardsia carnea* (compare these forms). Thus the only criterion, if a genus is provided with a real pedal disc, is the presence of real basilar muscles.

Ophiodiscus (type *O. annulatus* R. Hertw.). This genus agrees with *Sicyonis* in the presence of considerably fewer tentacles than mesenteries, in the structure of the tentacles and of the oral disc, and in the differentiation of the mesenteries into sterile, filament-bearing and fertile, filament-loose mesenteries. Hertwig, however, (1882) does not mention a different development of both mesenteries of the same pair, which is possibly due to his having overlooked it, as the specimen was badly preserved. This is rather important, as Hertwig probably has also overlooked the same case in *Sicyonis crassa*. The only obstacle put in the way of a conjunction of *Ophiodiscus* and *Sicyonis*, would be, that the tentacles of *Ophiodiscus* are arranged in a cycle and that they are very long. It ought, however, to be observed that the tentacles were for the greater part torn off and that only bad fragments of them remained. Hertwig's figure of the exterior of *Ophiodiscus* is also very reconstructed. For my part I think that no conclusion, as to the real length of the tentacles, can be drawn on basis of the presence of the long tentacle-thread, as I have observed how very much prolonged perfectly slack tentacles of several Actinians can be. Finally, as to the supposed presence of pseudo-tentacles in *Ophiodiscus annulatus*, it has not been proved that the single pseudo-tentacle observed belongs to the animal[1]. Neither has Hertwig dared to add it to the genus nor to the species characters (compare also Simon 1892 p. 9). The presence of pseudo-tentacles in a deep-sea form is also very unlikely. On basis of the named cases I think that *Ophiodiscus* is identical with *Sicyonis* or at least nearly allied to it. Several authors as Mc. Murrich have referred *Ophiodiscus* to the family *Lebruniidae*. In reality this genus has nothing to do with *Lebrunia*, the structure of which is quite another.

Paractinia (type *P. striata* (Riss.). During a visit in Turin 1899 Professor Rosa presented me with 2 specimens which he had seen living, and determined as this species. The exterior of both specimens agrees well with the description by Andres, and there were no acrorhagi. An examination of the sphincter showed that it was well developed diffuse, but endodermal and different from that of *Actinia*. As no reproductive organs were developed its definite position is somewhat uncertain, but I think that *Paractinia* is the same genus as *Gyrostoma*.

Paractis type? It is questionable, which species of *Paractis*, enumerated by Milne-Edwards, may be regarded as the type. Only when this has been determined, we may proceed to characterize the genus.

Paranthus (type *P. chromatoderus*) (Schm.) and *Parantheoides* (type *P. crassa* Carlgr.). I have shortly characterized these genera (1898 p. 27). Concerning *Paranthus* I have shown, on basis of an examination of the type and of a species from N. America, that at least 12 pairs of mesenteries are perfect and that the reproductive organs arise already on the mesenteries of the first cycle. In opposition to this, Maguire (1898

[1] Stephenson (1920 p. 560—561) is of the same opinion.

p. 723) has stated that only six mesenteries were perfect in the type and that the mesenteries of the first order were fertile in one examined specimen, sterile in another. I have controlled my earlier observations and examined in all three specimens of *P. chromatoderus*. All three specimens were provided with 12 perfect pairs of mesenteries; the mesenteries of the second order do not reach as far down on the actinopharynx as the six first pairs. The two first cycles of mesenteries were fertile (2 specimens examined). Maguire has probably not sectionized the whole animals but drawn his conclusions from solitary sections. In the second *Paranthus*-species there were 3 cycles of mesenteries perfect, some of the mesenteries of the third cycle were perfect only in the uppermost part of the actinopharynx.

Concerning the genus *Parantheoides* I think that we may place it together with *Paranthus* as synonymous with this genus. The only difference between the two genera is that *Parantheoides* is shorter than *Paranthus*, but as the only dredged specimen was rather strongly contracted, it is possible that the difference is not so considerable as might be supposed from the exterior.

Phelliomorpha (type *P. crassa* (Dan.)) is synonymous with *Cactosoma*, belonging to the family Halcampidae (compare p. 124).

Phelliopsis (type *P. panamensis* (Verr.)). If this genus, proposed by Verrill 1899 p. 214), really is devoid of acontia but has basilar muscles, which will have to be verified first, it may belong to the family Paractiidae and form a distinct genus. Perhaps it is related to "*Paractis*" *ferax* (Stuckey 1909 p. 387).

Pycnanthus (type *P. maliformis* (Mc. Murr.)). This genus, characterized by Mc. Murrich (1893 p. 172) is a good genus. I have here given a more complete diagnosis of the genus and described two new species (compare further this genus).

Polysiphonia (type *P. tuberosa* R. Hertwig (1882 p. 56)). This peculiar genus has been explicitly described by myself (Carlgren 1918 p. 36).

Raphactis (type *R. nitida* Verr.) probably does not belong to this family. Possibly the genus is related to *Korenia*, *Amphianthus* etc. (compare *Synanthus*).

Sicyonis (type *S. crassa* R. Hertw.) placed by Hertwig 1882 into a special family Sicyonidae, is, as I have before suggested (1899 p. 40), a Paractiidae (compare this genus).

Stomphia (type *S. coccinea* (O. F. Müll.) = *S. Churchiae* Gos.) is, as I have before shown (1893), a distinct genus among the Paractiidae (compare this genus).

Synanthus (type *S. mirabilis* Verr.). On the basis of Verrill's short and imperfect original description (1879) of this genus, Andres (1883 p. 584) has suggested that it is a Zoanthid. It is probable that this suggestion is correct, which, however, cannot be decided until the type-specimen has been examined. On the other hand, I can verify that the species, which Verrill later (1883 p. 48 Pl. 5 fig. 9) describes as *P. mirabilis*, belongs to the Zoantharia (s. str.). The very description indicates that we have to do with such an animal and a control examination of a specimen, received by The United States National Museum, proves the specimen to be an Isozoanthus. I here give a short diagnosis of this species, still making the observation that the description of its exterior is imperfect, on account of the scarceness of the material:

Polyps solitary or connected with each other by inconsiderable, thin coenenchyme. Basal plate wide. Column cylindrical or conical. Tentacles well developed. Ectoderm of the column very high, continuous, very little incrusted (by spicula of sponges), provided with numerous oval nematocysts with very twisted threads, 19—25 × 7—8 μ in size. Mesogloea of the column thin, homogeneous, with sparse, scattered cells and cell-islets. Sphincter rather strong, endodermal, with few but rough folds. Nematocysts of the tentacles partly of the same kind as in the column and 17 × 7—22 × 8 (26 × 6) μ in size, partly narrower and broader in the basal end 22—24 × 3,5—4(5) μ, the spirocysts of the tentacles 17 × 1,5—2 to 26 × 3,5 μ. Ectoderm of the actinopharynx high, provided with nematocysts recalling those of the tentacles, the former 19—22 × 8—7 μ, the latter 23—26 × 3,5 μ. A well developed siphonoglyphe. Mesogloea of the whole actinopharynx thin. Mesenteries 28, symmetrically arranged according to the macro-type, thickened in the distal part. Microcnemes well developed. Longitudinal muscles relatively strong in the macrocnemes as well as in the microcnemes.

The species, described by Verrill (1899 p. 211) as *Synanthus mirabilis*, is, on the other hand, no Zoanthid. Though I have not seen this species, I am inclined to think that we have to do with a species of the genus *Stephanactis* R. Hertw. (*Stephanauge* Verr.) = ? *Amphianthus* R. Hertw. = *Korenia* Dan., which are all provided with acontia, though, according to my examination, in small numbers. The family Amphianthidae, proposed by R. Hertwig (1882), cannot be maintained. The directive plane namely is not constant in relation to the longitudinal axis of the pedal disc or to the axis of the Gorgonian skeleton. Besides, I have found that the mesenteries of the first order, except the directives, are fertile in these genera. I will come back to these genera in the second part of this work.

Tealidium (type *T. cingulatum* R. Hertw.) is a well marked genus. *T. cinctum* Stuck. does not belong to the genus (compare below).

According to this discussion, I think that the number of genera belonging to the family Paractiidae[1] must be considerably reduced.

I have before (1893, 1898) divided the Paractiidae into two subfamilies, Paractiinae[2] and Actinostolinae. The Actinostolinae is also 1893 (Nachschrift) proposed as a special family). To these subfamilies I have (1918) added that of Polysiphoniinae, all based on the different development of the mesenteries. Of these subfamilies Polysiphoniinae is well limited. It is more difficult to have the two former distinctly separated. It is true, that it is easy to separate the typical Actinostolinae, *Actinostola* and *Stomphia*, perhaps also *Sicyonis* from the typical Paractiinae, but as we find traces of the Actinostolid-development in such

[1] Since this was written, Stephenson (1920 p. 504) sketches the line of evolution for the old Paractiidae and the old Sagartiidae, and derives both these families from an hypothetical ancestor, *Eosagartia*, at the same time dividing the Paractiidae into three, the Sagartiidae into five, partly new families. I will not enter on a closer critical discussion of Stephenson's hypothesis now, but keep it for the second part of this work. Meanwhile, I think that Stephenson's conclusions will have to be considerably modified. According to my statements above, the division of the old Paractiidae into three families cannot be accepted. The representatives of the Marsupiferidae are Halcampids, and also the family Actinoscyphiidae must be dropped, based as it is on the presence of only 6 pairs of perfect mesenteries, while the new Paractiidae should have more than 6. The genus *Anthosactis* namely has 6, 8 or 12 perfect pairs of mesenteries. The genus, *Tealidium*, nearly related to *Anthosactis*, has at least 6 or 12 perfect pairs of mesenteries. Accepting Maguire's examinations of *Paranthus* as correct, this genus and even one and the same species should have now 6, now 12 pairs or in the Tybec-species 24 pairs of perfect mesenteries (compare above). It is evident that under such circumstances the relations between the Sagartiidae and the Paractiidae will have to be seen from another point of view than that of Stephenson. Concerning the family Sagartiidæ and Diadumenidae compare p. 19 and p. 21.

[2] I need not here further discuss Hertwig's formation of a special tribus Paractiniae for the genera *Sicyonis* and *Polyopis*, as this tribus was abolished long ago, nor the affinity supposed by Hertwig between the Sicyonidae and the Tetracorallia. It is inconceivable that such a well differentiated genus as *Sicyonis* should be nearly related to the primitive Tetracorallia. If a relationship between the Tetracorallia and the Actiniaria really is a fact, it must be between such primitive Actinians as the Halcuriidae and the Tetracorallia (compare Carlgren 1918).

forms as *Pycnanthus* and possibly also in *Parasicyonis* (compare below) it is questionable, if the subfamily Actinostolinae may be maintained.

The exterior of the Paractiidae is rather uniform, especially that of the column which is smooth or in a few forms tuberculated. Also the tentacles in the genera seem to agree well. They are commonly short, smooth, or in contracted state wrinkled, or sometimes longitudinally sulcated. In several forms they are more or less bulbous on the outside of the base as in *Actinoscyphia, Pycnanthus laevis,* but not in *P. densus* and *maliformis, Sicyonis crassa, tuberculata* and *ingolfi* (but not in *S. variabilis*), *Ophiodiscus* and some *Actinostola*-species. As they sometimes appear only in certain species of a genus, their occurrence is rather insignificant as a genus-character, even in certain cases as a species character; I have namely in *Actinostola callosa* found all transitory stages between tentacles with bulbous thickenings (*A. atrostoma*) and tentacles without such (compare *A. callosa*). This variation of a species does, however, not prevent that the bulbous thickenings may be more constant in other species or in certain genera. In the genera *Anthosactis* and *Tealidium* we meet with a special differentiation of the tentacles. At the sometimes thickened base of the outside of the outer tentacles there is a well developed stinging battery, containing large, closely placed nematocysts of a special appearance (compare these genera). Similar capsules, though considerably smaller, appear in *Actinostola* and *Stomphia*, but are here arranged mainly in the apex of the tentacles.

The tentacles are commonly hexamerously grouped, in *Anthosactis jan mayeni* octomerously. In *Stomphia* the tentacles of the second cycle are twice the usual number or almost so, and the arrangement 6 + 12 + 18 etc. or 6 + 10 + 16 etc. Also in *Sicyonis* the tentacles are probably arranged in a similar manner. In *Actinoscyphia* they are found close by the margin of the oral disc in only two cycles. Possibly that is the case also in *Epiparactis*. In *Polysiphonia* the tentacles are placed in 12 triangular, continuous groups with the largest tentacles, corresponding to the first and second cycles of endocoels, in the innermost parts of the groups.

The longitudinal muscles of the tentacles are wholly ectodermal in *Actinoscyphia, Archactis* (*Antholoba*?) *perdix, Anthosactis ingolfi, Antiparactis, Epiparactis, "Paractis" ignota* and *ferax* and *Paranthus*, ectodermal to meso-ectodermal in *Antholoba* and *Anthosactis jan mayeni*, meso-ectodermal to ecto-mesogloeal? in *Anthosactis* (*Alloactis*) *excavata*, and mesogloeal in *Actinostola, Aulorchis, Cymbactis, Hormosoma, Ophiodiscus, "Paractis" papaver* and *polaris, Parasicyonis, Pycnanthus, Polysiphonia, Sicyonis, Stomphia* and *Synsicyonis*.

The genera and species, with the longitudinal muscles of the tentacles either ectodermal or mesogloeal, have the radial muscles of the oral disc arranged in a similar way. In *Antholoba* and *Archactis perdix* they are more enclosed in the mesogloea and thus ecto-mesogloeal, in *Anthosactis jan mayeni* meso-ectodermal and in *A. excavata* ecto-mesogloeal.

The siphonoglyphes are always present and well-developed.

The mesenteries in most genera show a regular development and are commonly hexamerous, in *Anthosactis jan mayeni* octamerous. Both mesenteries of the same pair are for the greater part equivalent; in *Actinostola, Stomphia, Sicyonis* and perhaps also in some other genera they show a different development of the younger cycles. In the latter case they follow the *Actinostola*-rule. Traces of such an arrangement we find also in other genera (compare above). In *Polysiphonia* there are, when 12 pairs of mesenteries have regularly arisen, 12 development zones, in which the origin of new mesenteries takes place bilaterally from both sides of the exocoels towards the centre of these latter.

Some genera show a richer development of mesenteries in the distal than in the proximal part. This is the case with *Cymbactis*, *Synsicyonis* and probably also with *Antholoba* (*Archactis*), in other genera the reversed takes place as in *Stomphia*, *Pycnanthus*, *Parasicyonis*, *Sicyonis* and probably also in *Ophiodiscus*.[1] Only six pairs of perfect mesenteries are present in *Actinoscyphia*, *Epiparactis*, *Paranthus*? (sometimes), *Antiparactis* and "*Paractis*" *ferax*. In the genus *Anthosactis* we meet in *ingolfi* 6 pairs of perfect mesenteries, in *jan mayeni* 8 and in *excavata* 12. In the other genera there are 12, or commonly more, perfect mesenteries.

Also the distribution of the reproductive organs varies in the different genera. In the following genera (and species) the reproductive organs begin to develop on the mesenteries of the first cycle.

Ammophilactis, *Anthosactis*, *Hormosoma*, "*Paractis*" *ferax*, *ignota*, *polaris*, *papaver*, *Paranthus*, *Phelliopsis* and *Tealidium*.

The producing of reproductive organs begins on the second cycle in *Actinoscyphia* and *Antiparactis*, on the third in *Pycnanthus*, *Actinostola*, *Polysiphonia* and *Stomphia* (partly), and on the fourth in *Antholoba*. In the following genera, *Ophiodiscus*, *Parasicyonis*, *Sicyonis* and *Synsicyonis*, as a rule only the mesenteries of the last order are fertile. In *Parasicyonis* these mesenteries are provided with filaments, in the other three genera not.

The longitudinal muscles of the mesenteries are, in comparison to the size of the animal, rather weak and commonly form weak pennons or none. More developed they are for inst. in *Hormosoma* and *Stomphia*. The best developed pennons we find in elongated forms, such as in *Paranthus* and "*Paractis*" *ferax*. The parieto-basilar muscles are commonly well-developed, and so are also the basilar muscles.

Genus **Anthosactis** Dan.

Diagnosis: Paractiidae (Paractininae) with well developed basal disc, with smooth, rather low body-wall, which is devoid of tubercles, acrorhagi and spirocysts, but more or less distinctly longitudinally sulcated (in contracted state). Sphincter strong to very strong, not stratified, on transverse sections partite in small meshes. Tentacles short, not particularly numerous, broad at the base, thinner at the apex, often longitudinally sulcated, the inner longer than the outer ones or all of almost equal length. Outer cycles of tentacles on the exterior side at the base with a well-developed stinging battery containing very large, particular nematocysts. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal to meso-ectodermal, those on the inner side at the base considerably stronger than those on the outer side. Oral disc very wide, in contracted state of the body strongly excavated. Actinopharynx short, with few

[1] It is true that Hertwig speaks of the presence of only 48 pairs of mesenteries and of almost 100 tentacles in *Ophiodiscus annulatus*, but a closer examination of the figure 3 Pl. 10, encluding about one fourth of the oral disc, shows, that Hertwig has overestimated the number of tentacles so as to double the number. Probably this mistake is due to the bad preservation of the tentacles or rather to an error in writing. If we namely consider the following suggestion by Hertwig, concerning the muscle-mesenteries (not the with these latter alternating fertile mesenteries) in *O. sulcatus* (1882 p. 55): "Da im Ganzen 48 Tentakeln vorhanden sind, so wird sich die Zahl der Muskelsepten gleichfalls auf 48 oder auf 24 Paare belaufen", we find, that the number of mesenteries in this species is probably twice that of the tentacles.

longitudinal furrows and 2 siphonoglyphes. Few (6, 8 to 12) perfect pairs of mesenteries. Longitudinal muscles of the mesenteries comparatively weak. Reproductive organs present, at least on all stronger mesenteries.

Danielssen (1900) declares that the genus is provided with cinclides, and refers it to the family Sagartiidae. According to my examination of the type-specimen, no such cinclides are present (compare below!). The genus is besides a typical Paractiidae and easily recognizable on the structure of the tentacles, for one thing. Their longitudinal muscles are namely at the base much weaker on the outside than on the inside, and ectodermal to meso-ectodermal, perhaps sometimes ecto-mesogloeal (in *A. excavata* (R. Hertw.)). Furthermore, outer tentacles are at the base on the outside provided with a strong battery of very long and broad nematocysts of a characteristic type, an arrangement, observed by myself only in the genera *Anthosactis* and *Tealidium*. Probably this battery has the same function as the acrorhagi.

To this genus I have before (1912 p. 43) placed *Paractis excavata*, described by R. Hertwig (1882), for which species Verrill (1899 p. 144) has proposed the name *Alloactis excavata*. The whole habitus and the anatomical structure of this species indicate that we have to do with a species of *Anthosactis*. It remains, however, to be ascertained, if the outer tentacles are provided with the above named particular nematocyst batteries.

Anthosactis jan mayeni Dan.

Pl. 2. Figs. 6—7.

Anthosactis jan mayeni n. sp. Danielssen 1890 p. 24, Pl. 2 fig. 1, Pl. 10 fig. 1.

— — — Dan. Carlgren 1912 p. 21, 1916 p. 1.

Diagnosis: Pedal disc with a cuticle. Column with more or less distinct longitudinal furrows. Tentacles conical, longitudinally sulcated in contracted state, not hamiform, in 4 or 5 octamerously arranged cycles, of which the first and the second are very close. Inner tentacles thicker and longer than outer ones. Outer tentacles a little swollen at the base. Longitudinal muscles on the outside almost exclusively ectodermal and not as strong as on the inside, where they are even meso-ectodermal. Oral disc with weak radial ridges and weak, partly mesogloeal muscles. Actinopharynx with few, longitudinal ridges. Pairs of mesenteries arranged octamerously (8 + 8 + 16 + an imperfect fourth cycle in large specimens). Only 8 pairs perfect. Small oral stomata, no marginal stomata. Parietobasilar muscles broad but only a little folded, about two thirds as long as the mesenteries. Ectoderm of the column with nematocysts 22—24 × about 4 μ (seldom 29 × 6 μ) in size. Ectoderm of the tentacles with extraordinarily numerous spirocysts of variable size, unto 53×4—6 μ, and with very sparse nematocysts (26—29 × 4(5) μ). Stinging capsules in the battery of the outer tentacles very numerous 74—93 × 12—13 μ. Typical nematocysts in the ectoderm of the actinopharynx few 22 × 3,5 μ, its nematocysts with distinct basal part to the spiral thread very numerous, 26—34 × about 5 μ.

Colour of the column pale reddish-white, but on account of the red oesophagus it acquires a reddish tinge, while the uppermost margin is white. Tentacles rose-red, shading off a little into yellow. Oral disc darker yellowish-red with paler yellowish-white rays, radiating from the mouth towards the middle of the disc. The gonidial grooves yellowish-white. When the animal is placed in alcohol the fluid becomes bright brownish-violet, and also the animal itself acquires a deep violet colour (Danielssen).

Dimensions in preserved state unto 3,4 cm broad at the base; length of the column 2,5 cm, length of the inner tentacles 0,8 cm, that of the outer ones 0,6 cm. Danielssen states the breadth to 4 cm.

Occurrence: West Greenland. Baffin bay 75°26′ N. 67°27′ W. 250 fms. (Sofia-Exp.). Umanak 250 fms. (1860).

East Greenland. 76°6′ N. 13°26′ W. 100—125 fms. (Danmark-Exp.); 72°25′ N. 17°56′ W. 300 m (Sw. Polar-Exp. 1900).

Greenland without distinct locality.

Jan Mayen (Norw. N. Atlantic-Exp. 1877).

Kara Sea. 72°19′ N. 55°54′ E. 90 m (Duc d'Orleans-Exp. 1907). 73°34′ N. 57°56′ E. 60 fms. (Nova-Zembla-Exp. 1875). 73°38′ N. 63°45′ E. (Nordenskiöld's-Exp. 1876).

Exterior aspect: This species has been described by Danielssen before (1890), but in several respects erroneously. The pedal disc is provided with a well developed cuticle and is enlarged, but it is surpassed in breadth by the oral disc, when the latter is expanded. The column is smooth, in contraction more or less wrinkled, without distinctly marked longitudinal furrows, corresponding to the mesenteries. As the animal is wholly extended the folds between the furrows disappear, wherefore the surface becomes smooth (Danielssen). A specimen, reproduced in the figure 6 Pl. 2, is provided with some irregular apertures in the column. As far as I can see, these apertures are no cinclides, as Danielssen has supposed, but artificial products, and probably apertures, remaining after the specimen's having been damaged and regenerated. In the other specimens I have not found any apertures, which speaks for the opinion that they are not normal formations. Besides, the column is rather thin (according to Danielssen, in extended state almost membraneous and transparent); in the distal part it, however, reaches a considerable thickness, owing to the strong development of the sphincter. No fossa is present. The tentacles are, as a rule, octomerously arranged in four cycles (8+8 + 16 + 32). The two inner cycles are, however, so close by one another that we can say that there are only three cycles, as Danielssen states. In the type-specimen and in a specimen, taken during the "Danmark"-Expedition, the number of tentacles was 64, in a third specimen there were 68 tentacles; among these, four tentacles were of a fifth cycle, developed close by the one pair of directives, in a fourth there were 80 tentacles. In the last case there were 16 tentacles of a fifth cycle, in two octants, one of each side of the one pair of directives. The inner tentacles were only a little longer than the outer, but much broader. The form of the tentacles as usual conical, the outer tentacles were a little swollen on the outside at the base. All tentacles were in contracted state provided with distinct longitudinal furrows and with a distinct aperture in the apex.

The oral disc was strongly excavated in the contracted state of the animal (fig. 6 Pl. 2) and provided with distinct radial furrows, corresponding to the insertions of the mesenteries. As the oral disc is wholly extended, its diameter may be twice that of the pedal disc.

The actinopharynx is short and provided with few (5—8) furrows and ridges on each side (Pl. 2 fig. 7). The two, symmetrically situated, siphonoglyphes are broader in the oral part than in the proximal and, as Danielssen states, of an almost triangular form. In their uppermost part they are provided with distinct gonidial tubercles.

Anatomical description. The pedal disc has a rather thick cuticle. The ectoderm of the column is somewhat low and contains rather numerous nematocysts 22—24 × about 4 μ in size, and numerous mucus-cells. The mesogloea is in the proximal part thin or of ordinary thickness, corresponding to the different state of contraction, but swells out in the region of the sphincter and there forms a thick layer; it contains small protoplasma-poor cells. The endodermal circular muscles are weak, the mesogloeal sphincter, on the other hand, is very strong and juts out, during certain states of contraction, as a strong thickening towards the ectoderm, about as the sphincter of *Tealidium cingulatum* (Hertwig 1882 Pl. 6 fig. 2). In the upper part and in the greater part of its length it occupies almost the whole breadth of the mesogloea, proximally it decreases rapidly and takes up only the inner part of the mesogloea. The muscle meshes are very small, in certain parts very close, in other parts separated by larger lamellae of the mesogloea. Any distinct stratification of the sphincter is, however, not to be seen (textfig. 183).

The ectoderm of the tentacles is very high and contains very numerous spirocysts of very variable size, unto 53 × 4—6 μ; on the other hand, the typical nematocysts are very sparse and 26—29 × 4—(5) μ in size. In the swollen basal part, on the outside of the outermost tentacles, there is a specific stinging organ developed (textfig. 184), which I have also observed in *Tealidium jungerseni*. This battery contains very numerous, closely packed nematocysts (fig. 184 *n*) of considerable size (74—93 × 12—13 μ), which are, however, smaller than those of *Tea-*

Fig. 183

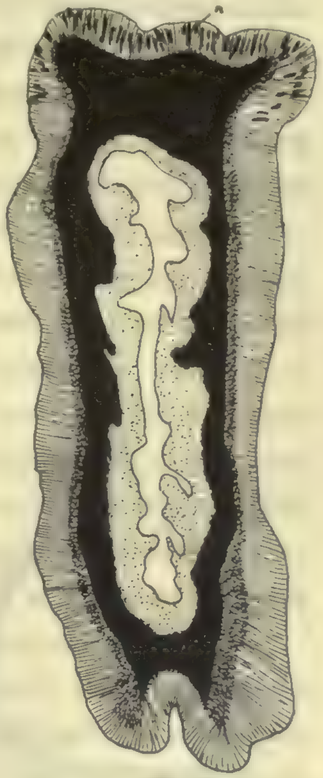


Fig. 184

Fig. 185

Fig. 186

Textfigs. 183—186. *Anthosactis jan mayeni.*

Fig. 183: Transverse section of sphincter. Fig. 184: Transverse section of an outermost tentacle, at the basis showing the battery of nematocysts (*n*). Figs. 185—186: Transverse section of an inner tentacle fig. 185 at the abaxiale, and fig. 186 at the adaxiale side.

lidium but larger than those of *Anthosactis ingolfi*. The thread of the nematocysts is very twisted but is often scarcely visible in the maceration preparations; for the greater part it is only the very close points of recurvation of the thread which are seen through the wall of the capsule. The inner tentacles are devoid of such a stinging battery. The longitudinal muscles are, on the abaxial side at the base, weaker than on the adaxial, though also on the former side rather strong; further upwards the muscles of both sides are of about equal strength. On the abaxial side the muscles are mostly ectodermal, though also here and there muscles, enclosed in the mesogloea, appear (textfig. 185); towards the adaxial side the mesogloeal muscle-meshes are more numerous, so that the muscles may be called meso-ectodermal here (textfig. 186). The radial muscles of the oral disc recall those on the adaxial side of the tentacles and are meso-ectodermal and more strongly developed in the outer parts than in the inner, where they are rather weak. The ectoderm of the actinopharynx is somewhat low, especially in comparison to the mesogloea, and contains few nematocysts of typical appearance, about $22 \times 3{,}5\ \mu$ long; on the other hand, the nematocysts with discernible basal part to the spiral thread are rather numerous. They are broader in the basal end and 26—$34 \times$ about $5\ \mu$ in size.

The mesenteries are octomerously arranged, which I have ascertained by the examination of several specimens and also of the type-specimen. Danielssen, however, declares that the mesenteries are hexamerously arranged, but that is not the case and does not correspond with the arrangement of the tentacles, the agroupment of which Danielssen has correctly stated. In the specimens with 64 tentacles the pairs of mesenteries were 32 (8 + 8 + 16), in those with 80 tentacles there were in one half, counted from the one directive pair, 20 pairs (4 + 4 + 8 + 4) developed. The four pairs of the last cycle are arranged in an octant next to the one directive pair. The arrangement of the tentacles on the other half indicates that also this part has the mesenteries grouped in the same manner. The eight first pairs of mesenteries are perfect. The longitudinal muscles of the mesenteries are not very strong and form no distinct pennons. The folds are however, numerous but low, with the exception of the innermost part, where they show a little tendency to form weak pennons; in the other parts of the stronger mesenteries they are uniformly developed. The parietobasilar muscles are distinctly marked, but the muscle lamella is not folded, it is extended over two thirds of the length of the column. The transversal muscles are rather well-developed in the distal part. The basilar muscles are well-developed and folded. A small oral stoma is present on the perfect mesenteries, on the other hand, there are no marginal stomata; I have, however, found a rather large aperture about in the middle of one mesentery. The ciliated tract of the filaments is strong, its mesogloea thick and containing numerous cells. The species is dioecious; all mesenteries, at least in the specimens with 32 mesenteries, are fertile. The statement of Danielssen, that the 6(!) first pairs of mesenteries are sterile, is wrong. The acontia are absent.

Anthosactis ingolfi n. sp.

Diagnosis: Pedal disc without a cuticle. Column in contracted state with longitudinal furrows in the upper part. Tentacles conical, not longitudinally sulcated, in numbers 48 (6 + 6 + 12 + 24), of which the first and the second cycle are very close. Inner tentacles thicker and longer than outer ones. Longitudinal muscles of the tentacles ectodermal, on the inner side at the base very strong. Oral disc with weak ectodermal, radial muscles. Actinopharynx with few (about 10) longitudinal ridges. Pairs of mesenteries arranged hexamerously (6 + 6 + 12); only 6 pairs perfect. Parietobasilar muscles like those of *A. jan mayeni*. Typical nematocysts in the ectoderm of the column?, in the tentacles absent (? or if present very sparse). Particular stinging capsules of the stinging battery very numerous 53—75 × 11—13 μ. Spirocysts of the tentacles very numerous, from 22 × 2 μ to 55 × 3 (3,5) μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx rather numerous, 26—34 × 5 μ.

Colour?

Dimensions: Breadth of the pedal disc 2,4 resp. 2,7 cm, length of the column in contracted state about 1,3 cm.

Occurrence: 66°08′ N. 16°02′ W. 729 fms. Bottom temp. ÷ 0,8 (Ingolf-Exp. St. 125) 2 sp.

Textfig. 187. *Anthosactis ingolfi*. Transverse section of inner tentacle.

Exterior aspect: The pedal disc is broad and does not seem to form any cuticle. The form of the body is in contracted state rather low and almost hemispheric. The surface of the body-wall is smooth; in the distal part there were indistinct longitudinal furrows present. The tentacles are short, the inner considerably broader and larger than the outer, in number 48, probably hexamerously arranged (6+6+12+24), the two first cycles are, however, very close. Because of the strong contraction of the specimens it was difficult to get a satisfactory diagram of the arrangement of the tentacles. The form of the tentacles varies from cylindrical to a little conical; I have not observed any longitudinal furrows on the tentacles, only indistinct transversal furrows, arisen by the contraction. The oral disc is very wide and smooth, and in contracted state deeply excavated. The actinopharynx is short and, on account of the contraction, transversally wrinkled, with aboral prolongations on the 12 perfect mesenteries, and provided with 10 longitudinal furrows between the insertions of the mesenteries. Two siphonoglyphes are present.

Anatomical description: The ectoderm of the column is thin and almost totally lost, so that I cannot give any information of its structure. The mesogloea is thin or of ordinary thickness, in the region of the sphincter, however, very thick. The sphincter is very strong and recalls that of *A. jan mayeni*. The muscle meshes are small and now very closely packed, now more sparse; the sphincter shows, as far as I can see, no tendency to stratification. The endodermal circular muscles are weak. The ectoderm of the tentacles is high and probably contains no typical nematocysts, if really present they are very sparse. The outer tentacles are on the outside of the base provided with a stinging battery as in *A. jan mayeni*. The nematocysts are, however, smaller here and variate in both specimens between 53 and 75 μ in length and 11—13 μ in breadth. The spirocysts of the tentacles are extraordinarily numerous, between 22 × 2 to 55 × 3,5 μ in size. The longitudinal muscles of the inner tentacles are much weaker on the outside of the base than on the inside. The inner folds are namely much closer and often more than double as high as the outer folds. They are often branched (textfig. 187 transverse section of inner tentacle). In contradistinction to

A. jan mayeni and *A. excavata* the muscles are not enclosed in the mesogloea but ectodermal. In the upper part of the tentacles the longitudinal muscles are weaker and uniformly distributed. The radial muscles of the oral disc is weak and ectodermal. The ectoderm of the actinopharynx contains rather few nematocysts with discernible basal part to the spiral thread, 26—34 × 5 μ in size. I have besides in the maceration preparations found some small nematocysts and some spirocysts, but whether they belong to the actinopharynx or stick to the ectoderm, I cannot decide. The siphonoglyphes do not seem to be as sharply marked as in *A. jan mayeni*.

Both specimens had 24 pairs of mesenteries, hexamerously arranged. Only the 6 first pairs were perfect. The mesenteries were in both specimens much thinner than in *A. jan mayeni*, the folds of the longitudinal muscles are low and form no pennons. The parietobasilar muscles recall those of *A. jan mayeni*, but are weaker. The filaments have the same appearance as in this species. All mesenteries are fertile and provided with filaments. The animal is dioecious.

Genus Tealidium R. Hertw.

Diagnosis: Paractiidae with well-developed, enlarged basal disc. Column with numerous small papillae of the mesogloea, all of the same size, with more or less distinct longitudinal furrows, in contracted state very low, disc-like. Sphincter mesogloeal, very strong, in certain states of contraction issuing as a strong circular fold in the uppermost part of the column. Tentacles short, conical, hexamerously arranged, not numerous, the inner longer than the outer or almost of the same length. Stinging battery on the outer tentacles as in *Anthosactis*. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. Oral disc wide. Actinopharynx short with two distinct siphonoglyphes. Pairs of mesenteries few, hexamerously arranged, thin and with probably weak muscles. 6 pairs, or a few more, perfect. Reproductive organs appearing already on the mesenteries of the first cycle incl. the directives.

The genus *Tealidium* is nearly related to *Anthosactis* with which it agrees in most characters, among others in the presence of the stinging batteries on the outside of the outermost tentacles. The nematocysts of these batteries are also of the same type as in *Anthosactis*. In contradistinction to *Anthosactis* its column is provided with very numerous, small mesogloea-papillae. Concerning the ectoderm of these papillae I cannot give any informations, as the ectoderm was lost in the specimens of *T. ingolfi*, as well as in the type-species.

The diagnosis of the genus, given by R. Hertwig, is not good, as among the proposed genus-characters only one — the presence of the above named papillae — is preservable. The tentacles of the species, described below, are namely of different length. It is also questionable, if in *T. cingulatum* the form of the sphincter may serve as a diagnostic. I, for my part, am more inclined to regard the wall-shaped thickening of the mesogloea in the sphincter region as due to a strong contraction of this part, because in the species, described below, and in one and the same specimen, the appearance of the sphincter varies in different places, evidently according to the state of contraction, and now recalls the sphincter of *T. cingulatum*, now is typically elongated.

The species *Tealidium cinctum* (Stuckey. Trans. New Zeeland Instit. 41. 1908-1909, p. 389) is certainly no *Tealidium*. Stuckey namely declares that the species is provided with "verrucae, which act as suckers, by which the animal covers itself with bits of shell and other debris." In the real *Tealidium* no sucking-verrucae are present, the papillae are namely here, as I have stated before, thickenings of the mesogloea. If this species really is a Paractid, it must have a new genus name. I provisionally propose *Paratealidium*.

Tealidium jungerseni n. sp.

Diagnosis: Basal disc very thin. Body-wall in the distal part with rather distinct longitudinal furrows. Sphincter now concentrated, now more elongated, not longitudinally stratified. Tentacles 48, conical, not longitudinally sulcated, with somewhat thickened mesogloea on the outer side at the base. Longitudinal muscles of the tentacles rather well developed also on the outer side, though weaker here than on the inner side, with closely packed, palisade-shaped folds. Actinopharynx very short with about 6 longitudinal furrows on each side. Pairs of mesenteries 24, of which at least 6 pairs perfect. All mesenteries fertile. Nematocysts in the ectoderm of the tentacles very sparse, $36 \times 2{,}5$—$3\ \mu$, its spirocysts very numerous, 19×2—$46 \times 3\ \mu$. Nematocysts of the stinging battery on the outermost tentacles very large, 106—134×11—$15\ \mu$. Typical nematocysts of the actinopharynx partly 29—$30 \times 3\ \mu$, partly 20—$25 \times 2{,}5\ \mu$. Nematocysts with discernible basal part to the spiral thread, 26—36×4—$5\ \mu$.

Colour?

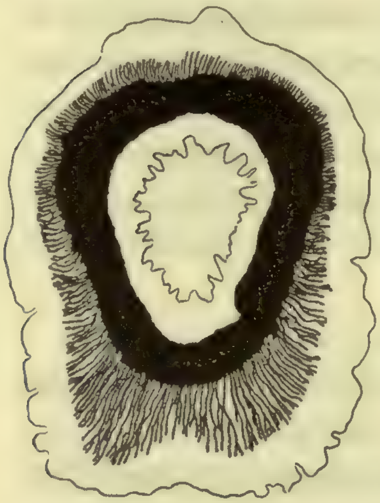
Dimensions: Height of the largest specimen 0,3 cm, breadth $3{,}5 \times 2$ cm. Inner tentacles 0,5 cm long.

Occurrence: Danmark Strait. 64°34′ N. 31°12′ W. 1300 fms. Bottom temp. +1,6° (Ingolf-Exp. St. 11) 3 sp.

Davis Strait. 59°12′ N. 51°05′ W. 1870 fms. Bottom temp. +1,3° (Ingolf-Exp. St. 38) 1 sp.

Exterior aspect: The pedal disc is very wide. The body is in contracted state disc-like, in one specimen a little elevated in the middle (in the sphincter region), in the specimen from the station 38 the body forms a low cone. The column is provided with very numerous, closely packed, small mesogloea-papillae, all of about the same size, towards the distal end they are somewhat scarcer and seem, at least partly, to be lacking in the region of the sphincter (in the capitular region). In the two largest specimens this region was provided with some irregular protuberances, which may possibly have arisen by the strong contraction. The column is besides longitudinally sulcated, the furrows correspond to the insertions of the mesenteries and appear most distinctly in the distal, not involved part of the body. Sometimes transversal furrows are to be observed, they are certainly due to the contraction of the animals. The tentacles are thick at the base, tapering towards the apex, not longitudinally sulcated, and incurvate. In one specimen — I have examined two specimens concerning the tentacles — the tentacles were a little swollen at the outside of the base. The number of tentacles was 48, probably (6 + 6 + 12 + 24). The oral disc is very wide and thin, I cannot determine its structure as it was strongly extended, and its ectoderm lost. The actinopharynx is very short and provided with about 6 longitudinal furrows on each side of the sagittal axis. The two symmetrically placed siphonoglyphes are provided with aboral prolongations.

Anatomical description: The ectoderm of the column is lost, but to judge from fragments it seems to have been low. The mesogloea is in the greater part of the column rather thin and provided with the above named papillae; in the distal part, where the sphincter is situated, strongly thickened as in *Anthosactis*. The sphincter recalls that of *Anthosactis*, sometimes it is wall-shaped, thickened towards the ectoderm as in *Tealidium cingulatum*. As the sphincter in different regions of the same specimens of *ingolfi* displays both these appearances, I cannot find that the wall-shaped sphincter is efficient as a characterization of the species *T. cingulatum*. The endodermal circular muscles are weak. The ectoderm of the tentacles is high and contains very numerous spirocysts of varying size from 19 × 2 μ to about 46 × 3 μ. The typical nematocysts are very sparse here as in *Anthosactis jan mayeni*, and 36 × 2,5—3 μ in size. That also here stinging batteries appear in the same places as in *Anthosactis* I have ascertained on maceration preparations. The nematocysts were very close and were much larger than in *Anthosactis*, in as much as they vary from 106 to 134 μ in lenght and 11—15 μ in breadth. They were of the same structure as in *Anthosactis*. The inner tentacles are not provided with stinging batteries. It is true, that I have at the apex of these tentacles found some scattered, large nematocysts of the same size as in the stinging batteries, but a closer examination proved that the nematocysts were sticking to the ectoderm and thus not belonging to this part. The longitudinal muscles of the tentacles are ectodermal[1] and recall those of *Anthosactis ingolfi* (textfig. 188 transverse section of tentacle) as regards the distribution of the muscles. The folds are closer than in *A. ingolfi*. The mesogloea of the tentacles is from thick to rather thick, and somewhat swollen on the abaxial side at the base. The radial muscles of the oral disc was badly preserved and, as far I can see, ectodermal. The ectoderm of the actinopharynx contains typical nematocysts partly 29—30 × 3 μ, partly 20—25 × 2,5 μ in size, besides these, there are sparse nematocysts with discernible basal part to the spiral thread (length 26—36 μ, breadth 4—5 μ).



Textfig. 188. *Tealidium jungerseni*. Transverse section of tentacle.

The mesenteries were in both specimens badly preserved and thin, so that I cannot give any information concerning the muscles, on all accounts there are no distinct longitudinal pennons. Probably the muscles of the mesenteries agree with those of *Anthosactis ingolfi*. The number of mesenteries was 48, 6 + 6 + 12 pairs, among these two directives, symmetrically situated. The first pairs are perfect, it seems, however, that also a few of the second order reach the actinopharynx; the mesenteries of the third order occupy one half of the oral disc. The filaments were also badly preserved, the cnido-glandular tract contains very large mucus cells. The species is dioecious, and all mesenteries have reproductive organs.

Genus **Epiparactis** n. gen.

Diagnosis: Paractiidæ with well-developed pedal disc. Column not much elongated, smooth, with thick cartilaginous mesogloea, without distinct margin. Sphincter not strong. Tentacles rather short, the inner longer than the outer, conical, comparatively thin, whithout basal thickenings and stinging batteries on the outside of their base, closely packed on the outer rim of the wide oral disc, arranged in at least two, probably in three cycles. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal.

[1] Possibly some few folds may fuse together.

2 distinct siphonoglyphes. Mesenteries numerous, thin, but only 6 pairs perfect. Muscles of the mesenteries weak. Distribution of the reproductive organs?

The below described species is probably nearly related to "*Actinernus*" *saginatus* and *aurelia*, but is distinguished from them by the tentacles being devoid of basal thickenings. Unfortunately, on account of the bad preservation of the specimen, I can neither decide, whether the tentacles are arranged in two or three cycles (compare below), nor how the reproductive organs are placed in the mesenteries. So far, it is the most practical to propose a new genus. If it were to be found out afterwards, that "*Actinernus*"[1] sometimes can be devoid of tentacle-tubercles, *I. dubia* probably belongs to this genus.

E. dubia n. sp.

Diagnosis: Pedal disc with a cuticle. Sphincter comparatively weak, filling up only part of the mesogloea, not longitudinally stratified, consisting of small meshes, showing a tendency to transversal stratification, distinctly separated from the endodermal column muscles, and not continued in those latter. Tentacles smooth to indistinctly longitudinally sulcated, numerous (about 124). Longitudinal muscles of the tentacles and radial muscles of the oral disc ordinarily developed. Oral disc with radial ridges and furrows, especially well developed in the outer part. Actinopharynx of ordinary length. Siphonoglyphes with aboral prolongations. Pairs of mesenteries hexamerously arranged in five cycles (6 + 6 + 12 + 24 + about 24, of which the last as a rule are developed only in the outer exocoels). Only 6 pairs of mesenteries perfect. Longitudinal muscles form weak pennons only in the inner part of the mesenteries. Nematocysts in the tentacles and the actinopharynx numerous, in the former 26—34 × 4—5 μ, in the latter 24—41 × 3,5—5 μ. Spirocysts of the tentacles very numerous 19 × 1,5—2 to 67 × 7 μ.

Colour?

Dimensions: Length and breadth about 3 cm. Inner tentacles about 1,5 cm long.

Occurrence: 60°37′ N. 27°52′ W. 799 fms. Temp. at the bottom 4,5° (Ingolf-Exp. St. 78) 1 sp.

Exterior aspect: The pedal disc is wide and deeply excavated, on account of its covering a sponge, of which rests remain behind. On several parts of the disc there are fragments of a cuticle. The column is about as long as broad, smooth and of about the same thickness as in *Sicyonis*. There is no distinct margin. The tentacles are broad at the base, diminishing towards the apex and rather short and thin. They are indistinctly transversally wrinkled; some of them are longitudinally sulcated. They are devoid of basal thickenings and basal stinging batteries. The inner tentacles are longer than the outer ones of which one part was very small. They were about 124 in number, a little fewer than those of the mesenteries. Their arrangement is difficult to determine, as the outer part of the oral disc was contracted and not well preserved, and small tentacles in development disturb their agroupment. Besides, they are closely packed on the outer rim of the oral disc. The tentacle cycles are possibly not more than 2 in number, at any rate not more than three. The oral disc is very wide and its greatest part without tentacles, in the innermost part smooth, in the outer with deep radial furrows. There are no gonidial tubercles. The actinopharynx is of ordinary length and irregularly wrinkled. The siphonoglyphes are distinct and provided with aboral prolongations.

[1] *Actinoscyphia* (p. 184).

Anatomical description: The ectoderm of the column is almost lost, only in the uppermost part there are some fragments proving it to be thin. The mesogloea is very thick, of the same consistency as in *Actinostola*, fibrillar with scattered, small, often round cells. The endodermal circular muscles are weak. The sphincter is comparatively weak, the meshes placed in groups showing a tendency to transversal stratification; it is the strongest on the upper part and gradually becomes weaker downwards. It occupies only one part of the breadth of the mesogloea and seems to be wholly separated from the entodermal circular muscles (textfig. 189). The ectoderm of the tentacles is high and provided with numerous typical nematocysts, which are rather broad in comparison to their length (26—34 × 4—5 μ), and with very numerous spirocysts of very variable size (from 19 × 1,5—2 μ to 67 × 7 μ). The ectodermal longitudinal muscles are not strong, the folds are rather low and commonly not branched, but rather close (textfig. 191). There is no great difference in the development of the muscles on the adaxial and abaxial sides; at the base the muscles, however, are a little stronger on the adaxial side, and the mesogloea likewise a little thicker on the abaxial side of the base. Still we cannot speak of basal thickenings of the mesogloea. The mesogloea of the tentacles is commonly rather thin. The radial muscles of the oral disc is also ectodermal (textfig. 190), in its outer part stronger than in the tentacles and provided with rather high, close folds, of about the same dimension at the insertions of the mesenteries as at the ridges. The ectoderm of the actinopharynx contains numerous nematocysts, 24—41 × 3,5—5 μ in size.

Fig. 189

Fig. 190

Fig. 191

Textfigs. 189—191.
Epiparactis dubia.
Transverse sections of sphincter (fig. 189), of part of the oral disc (fig. 190) and of part of a tentacle (fig. 191) *cm*: circular muscles of the column.

The mesenteries are hexamerously arranged (6 + 6 + 12 + 24 + an imperfect fifth cycle). Only the 6 first pair are perfect. The imperfect mesenteries have been examined in 5/6 of the animal. The mesenteries of the fifth cycle were weak and generally present only in the outer compartments viz. beside the mesenteries of the first and second orders, sometimes they are lacking in some of those, sometimes they are also developed in the inner compartments beside the mesenteries of the third order. Both mesenteries of a pair were not developed in conformity with the *Actinostola*-rule. The mesenteries form thin lamellae.

Genus Pycnanthus Mc. Murr.

Diagnosis: Paractiidae with well-developed, enlarged pedal disc. Column smooth, without tubercles, in contracted state low and thin, sometimes with more or less distinct longitudinal ridges in the upper part. Upper parts of the column capable of involution. Margin tentaculate, distinct, not lobed. Sphincter weak or well developed. Tentacles short, only half as numerous as the mesenteries, the inner considerably stronger than the outer, the latter without stinging battery at the base. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. 2 deep siphonoglyphes. Mesenteries hexamerously arranged, but not always regularly, at least the first 2 cycles perfect. Longitudinal muscles of the mesenteries form no distinct pennons. Parietobasilar muscles more or less strong. Reproductive organs on the mesenteries of the third and fourth cycles, sometimes also on some of the fifth. No differentiation into filament-lacking fertile and filamentous sterile mesenteries. The weaker mesenteries, only in the most proximal part of the body, without filaments and reproductive organs.

The diagnosis which I have given here of the genus differs considerably from the original diagnosis, proposed by Mc. Murrich (1893). That this latter was not suitable, may be concluded from the fact that Mc. Murrich later on (1904 p. 245) has placed to the genus a species *Pycnanthus* (*Paractis*) *lineolatus*, which, to my mind, cannot be conjoined with the type, *maliformis*. In *P. lineolatus* the longitudinal muscles of the tentacles and the radial muscles of the oral disc namely are ectodermal, its perfect pairs of mesenteries are only 6, and its reproductive organs are developed on the mesenteries of the second and third orders, characters which differ so much from the type that they make it impossible to place both species to the same genus. The reason why Mc. Murrich has enclosed them in the same genus, is that both specimens are provided with capitular ridges; I for my part am very sceptical as to the systematic importance of the capitular ridges, at least of such as are here appearing, which may very well have arisen by the contraction of the distal part of the column. Stephenson (1918 b p. 124) has drawn the same conclusion concerning *Cymbactis* (= *Sicyonis* compare p. 211) *gossei*. According to Mc. Murrich, the ridges besides should not be of the same structure in both species, in the type *maliformis* "hollow with rather delicate walls", in the species *lineolatus* "solid." In the below described species *P. laevis*, which in all other important characters agrees with the type, there are no distinct capitular ridges. I therefore think that the capitular ridges are without importance as a genus character, having probably in many cases arisen by contraction. As I have introduced them above in the diagnosis of the genus they might be used; I will, however, declare that they seem to be of small systematic importance. To the genus characters Mc. Murrich also adds, that the tentacles are "not swollen at the base". The below described *P. laevis* is, however, provided with such swollen tentacles.

Mc. Murrich's *Pycnanthus lineolatus* must, to my mind, form a new genus type, with which possibly also *Paractis tenuicollis* may be placed. For this genus Verrill (1899 p. 212) has proposed the name *Antiparactis*, type: *A. lineolatus*, which may be characterized as follows. The diagnosis is based on Mc. Murrich's description of the type.

Paractiidae with well developed basal disc. Column smooth, without tubercles, in contracted state low and thin, sometimes with more or less distinct longitudinal ridges in the upper part. Margin tentaculate, not lobed. Sphincter strong. Tentacles short, only half so numerous as the mesenteries (always?). Outer tentacles without stinging batteries at the base. Longitudinal muscles of the tentacles and radial muscles of the oral disc ectodermal. Actinopharynx long with two siphonoglyphes. Mesenteries hexamerously arranged, only the 6 first pairs perfect. Longitudinal muscles of the mesenteries forming weak, broad pennons. Reproductive organs on the mesenteries of the second and third orders. No differentiation into filament-lacking fertile and filamentous sterile mesenteries.

Verrill (l. c.) wishes to substitute the name *dubia* for *lineolata*, as he considers it questionable, if the species, described by Mc. Murrich, is identical with Dana's species *lineolata*. Also Mc. Murrich (1904 p. 247) is a little uncertain about the identification of his species with *lineolata*. Verrill suggests that the species is a Sagartiid, which "had lost its acontia." As far as I can understand, there is no reason for such a supposition.

Pycnanthus laevis n. sp.

Pl. 3. Figs. 4, 5.

Diagnosis: Body in contracted state usually disc-like. Column rather thick, in contracted state sometimes with indistinct longitudinal furrows in the upper part. Sphincter strong, longitudinally stratified. Tentacles usually conical or seldom more cylindrical, according to the state of contraction, 96 in five cycles. Outer tentacles at the base, on the abaxial side thickened and without longitudinal muscles. Pairs of mesenteries about 96, the first, second, and one part of the third cycle perfect. Some pairs of the third cycle unequally developed, consisting of a perfect and an imperfect mesentery. Mesenteries of the last cycle, only in the most proximal part of the body, very small, without filaments. Parietobasilar muscles rather well developed. Typical nematocysts in the ectoderm of the tentacles numerous, 22×2—$31 \times 2{,}5\ \mu$, in the actinopharynx numerous, 25×2—$31 \times 2{,}5\ \mu$. Spirocysts in the tentacles very numerous, from 7×1 to $41 \times 4{,}5\ \mu$. Nematocysts with discernible basal part to the spiral thread in the ectoderm of the tentacles 31—36 $\times$ 3—3,5 μ.

Colour in alcohol: uncoloured.

Dimensions of the largest specimen in contracted state: diameter of the basal disc about $3 \times 3{,}5$ cm, height 0,6 cm. The smallest specimen was 0,7 cm broad and about 0,2 cm high.

Occurrence: Davis Strait. 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3°9 (Ingolf-Exp. St. 32) many spec. on stones.

W. of Faroe Isl. 61°31′ N. 11°36′ W. 720 fms. Bottom temp. 2°4 (Ingolf-Exp. St. 46) several spec.

Exterior aspect: The pedal disc is extended and most frequently thin. The form of the body is flat, almost disc-like when the animal is contracted, sometimes, as in the specimen reproduced in the fig. 5 Pl. 3, the column forms a low cone. The surface of the column is smooth, excepting small irregular invaginations, arisen by contraction. The uppermost part sometimes shows indistinct longitudinal furrows, and, between these, low ridges which are continued in the tentacles. These furrows and ridges are, however, not always distinct, it is thus probable, that they have arisen by the contraction of the distal part of the body-wall. The margin is distinct and not irregular. The outermost tentacles are small, arranged as palisades, and a little thickened quite at the base on the abaxial side; this thickening, being probably a continuation of the columnar ridges, however rapidly disappears. Mc. Murrich declares that the tentacles of the genus are not swollen at the base. As far as I can understand from Mc. Murrich's description of *Pycnanthus maliformis*, there may be a similar thickening as in *P. laevis* at the base of the outermost tentacles. Mc. Murrich (1893 p. 173) namely says: "The ridges upon the upper surface of the column run to the basis of the outer tentacles." The tentacles are conical, sometimes more cylindrical, according to the contraction. The number of tentacles is about 96 (6 + 6 + 11 + 24 + 48), the inner are many times larger than the outer. Sometimes the tentacles are indistinctly longitudinally sulcated. The oral disc is wide, its larger part has no tentacles. It is provided with indistinct radial furrows, corresponding to the insertions of the mesenteries. Actinopharynx is of ordinary length, irregularly wrinkled and provided with 2 deep siphonoglyphes.

Anatomical description: The ectoderm of the column is almost lost, only a few fragments of it were present in several invaginations. In these fragments I found nematocysts, 14—17 × about 1 μ in size. Its mesogloea is thick and shows the same differentiation into two layers, an outer, provided with numerous cells and an inner, fibrillar and poor in cells, as that which I have described more in details for *Sicyonis tuberculata*. The endodermal circular muscles are weak, the distinctly longitudinally stratified sphincter, however, strong. In the uppermost part it occupies almost the whole breadth of the mesogloea, diminishes rapidly and passes into the endodermal circular muscles (textfig. 192, 193). The ectoderm of the tentacles is high with very numerous spirocysts (size: from 17 × 1 μ to about 41 × 4,5 μ) and also rib-like typical nematocysts (size 22 × 2—31 × 2,5 μ). Besides these, there are sparse nematocysts with discernible basal part to the spiral thread (size about 31—36 × 3—3,5 μ). The mesogloea of the tentacles is thinner than the ectoderm. The longitudinal muscles form numerous, closely packed, radially extended meshes in the mesogloea. On the outside of the outermost tentacles, lowermost at the base where the mesogloea is a little thickened, the longitudinal muscles are lacking, the muscle-lacking part, however, being inconsiderable (textfig. 194). Not far from the base, scattered muscle fibres namely appear, rapidly increasing in number. The larger part of the outer tentacles displays uniformly extended muscles. The mesogloeal radial muscles of the oral disc are in the inner part of the disc weak and commonly only separated from the ectoderm by a thin lamella, in the outer parts strong with closely packed meshes, extended in ecto-endodermal direction. At the insertions of the mesenteries the muscles are interrupted by mesogloeal bridges. The ectoderm of the actinopharynx is of ordinary height and contains numerous nematocysts, 25 × 2 to 31 × 2,5 μ in size. Its mesogloea is thicker than its ectoderm, especially in the siphonoglyphes. Concerning the structure, the mesogloea of the actinopharynx agrees with that of the inner part of the column, in the siphonoglyphes and in the vicinity of these latter the mesogloea is not so strongly fibrillar; here as in the Zoantharia there are also scattered cell-islets.

Fig. 192

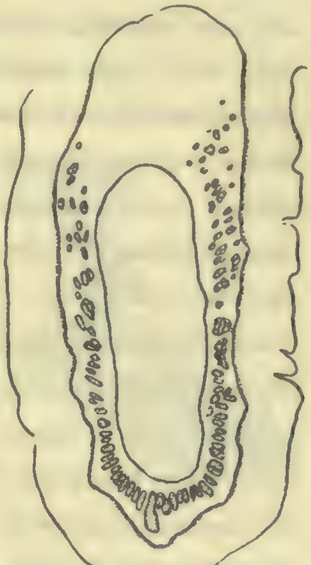


Fig. 194

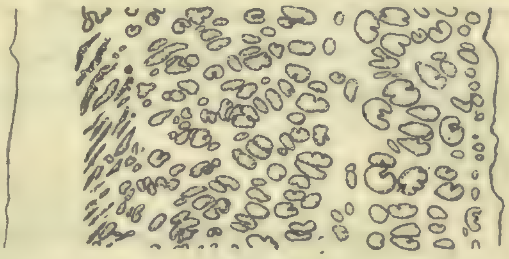


Fig. 193

Textfigs. 192—194. *Pycnanthus laevis.*
Fig. 192: Transverse section of sphincter. Fig. 193: Transverse section of part of the sphincter (in the fig. 192: indicated by dotted lines). Fig. 194: Transverse section of an outermost tentacle, next to its basis.

The number of the pairs of mesenteries is 96 or thereabout. The mesenteries are arranged in five cycles, of which the first and part of the third are perfect. Two examined specimens show the following arrangement of the mesenteries of the third cycle, counted from the one pair of directives *i*: imperfect, *p*: perfect mesenteries.

Sp. 1 (sectioned in transverse sections): *pp—pi—***p***p—p***p***—ip—pp—ip—ip—ip—pi—ip—ip*.

The mesenteries, designated by spaced out figures, are weaker than the other perfect mesenteries, and only reaching the actinopharynx with a small off-shoot.

Sp. 2 (the largest specimen) only one half examined: *ip — ii — ip — ii — ii — ii*. As I have only macroscopically examined this specimen, it is possible that some of the imperfect mesenteries are in reality perfect, but this I cannot with certainty decide as the specimen was rather badly preserved. On all accounts, the size of the mesenteries of the third cycle shows that one mesentery of a pair has grown more rapidly than its partner. A fully regular agroupment of these imperfect weaker and perfect stronger mesenteries does not seem to be present. The weakest mesenteries of the third cycle are, however, as in *Actinostola spetsbergensis*, commonly next to the mesenteries of the first order (compare *P. densus*). Both mesenteries of the pairs of the fourth and the fifth cycles seem to be equally developed. The sterile and filament-lacking mesenteries of the fifth cycle appear only in the proximal part of the body.

The longitudinal muscles form no distinct pennons, though the outermost and innermost parts of the mesenteries show a weaker muscularity than the intermediate parts. The folds of the muscles in the best developed part are not especially strong, only the distal part shows high folds. The parietobasilar muscles are distinctly marked, but hardly form any folds; they almost reach the sphincter. The basilar muscles are distinct, though not strong, with few, rather high folds. Oral and marginal stomata are present on the perfect mesenteries. The ciliated streaks of the filaments are well-developed. The mesenteries of the third and fourth cycles have reproductive organs, the other mesenteries are sterile. The species is dioecious.

Pycnanthus densus n. sp.

Diagnosis: Pedal disc wide. Column thick, with indistinct, irregular longitudinal furrows. Sphincter rather long, reticular, not stratified. Tentacles short, but broad, conical, thick and irregularly, transversely wrinkled in contracted state, about 90 to a little more than 100, and densely packed together, so that some tentacles are sharply outlined from each other at the base. Outer tentacles not swollen at the base. Radial muscles of the oral disc not distinctly interrupted at the insertion of the mesenteries, forming a net-work of large meshes close to the ectoderm. Pairs of mesenteries about 92 to 108, in four primary, symmetrically situated exocoels, more numerous than in the 2 other exocoels, which are situated on both sides of a directive pair. Sometimes there is a difference in size of both mesenteries of the same pair of the third and fourth cycles. Mesenteries of the last cycle only in the most proximal part of the body very small, without filaments and reproductive organs. Parietobasilar muscles distinctly outlined, reaching to the large marginal stomata. Typical nematocysts in the ectoderm of the tentacles numerous, 34—48 × 2,5—3 μ, in the actinopharynx 24—36 × 2—2,5(3,5) μ. Spirocysts of the tentacles 22 × 1,5—2 to 58 × 3,5 (48 × 4, 5) μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx 20—29 × 3—5 μ.

Colour?

Dimensions: Spec. 1) diameter of the body a little above the pedal disc 4 cm, height 3 cm. Inner tentacles about 1 cm long and broad. The specimen 2 was smaller, but more strongly contracted.

Occurrence: 64°53′ N. 10°0′ E. 630 m. Temp. at 600 m. — 0,69 (Michael Sars-Exp. 1900 St. 10) 1 sp. (Sp. 1).

Norway-Bear Isl. 73°27′ N. 23°11′ E. 460 m. Black, gray clay. Temp. at the bottom 2,67 (Swed.-Spitsberg.-Exp. 1898) 1 sp. (Sp. 2).

Exterior aspect: The pedal disc was wide, in specimen 1 for the greater part torn off, so that only the outer part was left. The body of specimen 1 was in contracted state conical, of specimen 2 more cylindrical, the distal part of the body of spec. 2 bending outwards and downwards. The ectoderm of the column was lost, the thick mesogloea shows irregular, longitudinal, indistinct furrows. The margin is tentaculate. The tentacles, partly covered by the column, are conical, about as long as broad, and irregularly, transversally wrinkled. The inner are considerably larger than the outer and show no basal thickenings at the outside. The number of tentacles was in specimen 1 about 90, probably 92, in specimen 2 104. The tentacles are very close and sometimes almost fusing together at the base, especially in spec. 1), so that the outlines between them are indistinct; in such cases the mesenteries reach into the tentacles, as textfigure 195 shows. The oral disc is rather wide and radially sulcated. The actinopharynx is well developed, with the deep siphonoglyphes being devoid of gonidial tubercles, but aborally prolongated. The actinopharynx is besides longitudinally sulcated, in specimen 2 there are about 12 longitudinal furrows on each side.

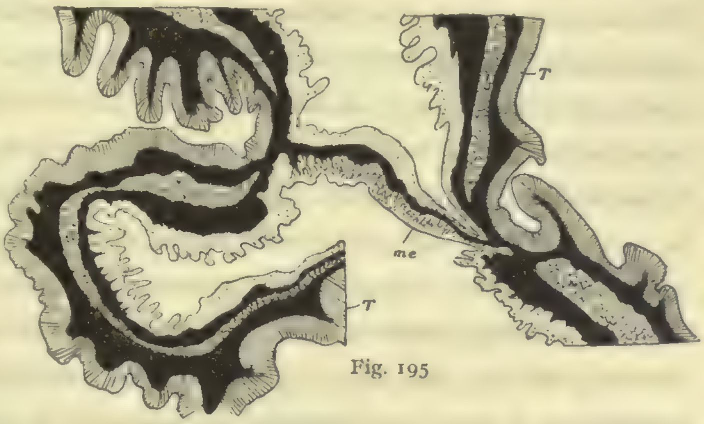


Fig. 195

Fig. 196

Fig. 197

Textfigs. 195—197. *Pycnanthus densus.*
Fig. 195: Transverse section of the basis of two tentacles (*T*). *me*: mesentery. Figs. 196—197: Transverse sections of the oral disc fig. 196 in the outer fig. 197 in the inner part.

Anatomical description: The ectoderm of the column is lost, its mesogloea is fibrillar and provided with numerous, small, branched, protoplasma-poor cells. The sphincter is strong, and in the distal part it almost fills up the whole breadth of the mesogloea, but rather soon decreases. It is on transverse sections reticular and recalls the sphincter of *Stomphia coccinea*, though it is less strong and less long. I have not observed any distinct stratification of the sphincter. The ectoderm of the tentacles is rather high and contains very numerous nematocysts and spirocysts. The size of the former is in spec. 1 36—48 × 2,5—3 μ (commonly they are 41—43 μ long), in spec. 2 34—41 × 3—2,5 μ, the latter variates in spec. 1 from 24 × 1,5 μ to 58 × 3,5 μ, in spec. 2 from 22 × 2 to 48 × 4,5 μ. The mesogloea of the tentacles is thicker than their ectoderm, the longitudinal muscles are found in the middle part of the mesogloea and show rather large meshes on transverse sections. The radial muscles of the oral disc (textfigs. 196, 197) are also mesogloeal, but approached to the ectoderm and in the outer part of the disc separated from it only by a thin layer of mesogloea (textfig. 196). The muscles seem to be continuous and not interrupted at the insertions of the mesenteries, the meshes of the muscles are rather large, like those of the tentacles. The mesogloea of the oral disc shows in the parts, which are not occupied by the muscles, a chondroid-shaped structure. The ectoderm of the actinopharynx contains typical nematocysts, the size of which is in spec. 1 29—36 μ long and 2,5 μ broad (a few nematocysts reach a size of 29 × 3,5 μ), in the spec. 2 24—31 × 2—2,5 μ. Besides these, there are here numerous nematocysts with distinct basal part to the spiral thread, in spec. 1 20—24 × 3—3,5 μ, in spec. 2 22—29 × 3,5—5 μ. In the maceration preparation I have found also spirocysts here, which, however, probably do not belong to the actinopharynx, but are attached to the ectoderm.

The number of the pairs of mesenteries was in spec. 1 probably 92. On one side of the animal, counting from one directive to the other, I observed 48 pairs, on the other side I examined only the larger pairs, being 22 in number. As there are pairs, alternating with these latter, of which I have convinced myself by the examination of some compartments, the number of the pairs of mesenteries is on this side probably 44. If we indicate the different cycles by letters — the mesenteries of the first order by Roman figures — the arrangement of the pairs of mesenteries is as follows. (*dm*: directive mesenteries. Concerning the spaced out figures compare below!).

On one side:

dm. I 4 3 5 4 5 2 5 4 5 3 4 I 5 4 5 3 6 5 6 4* 5 2 5 4 5 3 5 4 5 I 5 4 5 3 6 5 6 4 5 2 5 4 5 3 5 4 5 = 48 pairs,

on the other side:

4 3 5 4 5 2 5 4 5 3 4 I 5 4 5 3 6 5 6 4* 5 2 5 4 5 3—4— I 5 4 5 3 6 5 6 4 5 2 5 4 5 3—4—I dm. = 44 pairs.

As we see, the arrangement of the mesenteries is almost the same on both sides. The only difference is that 4 pairs of mesenteries of the fifth order are not developed on one side (in the lower line). On closer examination of the arrangement, it appears that it is irregular. In the primary exocoels, on both sides of one directive, we observe mesenteries of the second to the fifth orders, those of the fifth order are, however, developed only between the mesenteries of the third and second cycles, but not between those of the third and first. In the 4 other primary exocoels the mesenteries are numerous and show the same agroupment in all 4, excepting that 4 pairs of mesenteries are lacking on one side. In all these primary exocoels, mesenteries of the second to the sixth cycles are developed, those of the sixth cycle are, however, limited to eight pairs, two in each primary exocoel, on both sides of a pair of the fifth order. Comparing this arrangement with that of the Actinostolids we find a certain agreement. It is true, that both mesenteries of the same pair in the younger cycles of *Pycnanthus densus* generally are of the same size, but the failure or the retardation in the erection of the youngest cycles takes place in the compartments on the side, where the weakest mesenteries of the third order should be situated, if they were developed as in *Actinostola spetsbergensis*. In this species the weakest mesenteries of the third cycle are found next to the mesenteries of the first cycle, the stronger mesenteries next to the mesenteries of the second order. In *Pycnanthus densus* we see that in the first compartments, next to the one directive pair, the mesenteries of the fifth cycle are lacking between the directive pair and that of the third order, while such mesenteries are developed between the pair of the third cycle and that of the second. In the other primary compartments there are mesenteries of the fifth order, except on one side where they are lacking in four exocoels, placed between the mesenteries of the third and first orders. In eight exocoels, four on each side, mesenteries of a sixth cycle are present. If these latter were established in strict conformity with the rule of *Actinostola*, they should appear between the mesenteries of the fourth and second cycles. They have, however, here arisen between those of the third and fourth cycles, which seems to be connected with the fact (in contradistinction to the *Actinostola*) that the weakest mesentery of the fourth cycle (in the scheme marked with a *) stands next to the pair of the second cycle, not as in *Actinostola* next to that of the third. The with a * marked pair of the fourth order namely shows a different development of both mesenteries in the same pair, one being perfect, the other not.

The mesenteries of the second specimen were 216 in number. The arrangement of the 108 pairs agrees well with the agroupment of the mesenteries in spec. 1. The mesenteries of the sixth cycle namely have arisen in the same secondary compartments (between the mesenteries of the first and second orders) as in spec. 1 viz. counted from the one directive pair in the secondary compartments 3 and 5, on each side of the directive plane (compare the arrangement in spec. 1). The number of mesenteries was, however, in two such compartments a little more numerous here than in spec. 1, namely 11 pairs in compartment 5 on one side, and in compartment 3 on the other, instead of 9 in the two other compartments and in the corresponding compartments of spec. 1. In the other secondary exocoels there were mesenteries of the third to the fifth cycles, regularly arranged. Whether a difference in size exists between both mesenteries of the same pair in the mesenteries of the fourth cycle I cannot decide, as I did not want to cut up the specimen. For the same reason I have not examined the number of the perfect mesenteries here.

The mesenteries of the three first cycles were perfect in specimen 1. Two unpaired mesenteries of the fourth cycle besides reach the actinopharynx, as above mentioned. In a couple of cases I have observed a slightly different size of both mesenteries of the third cycle, the weakest mesentery in the pairs is next to the mesenteries of the first order. Though the arrangement of the mesenteries does not quite agree with that of the Actinostolids, it, however, seems to recall the latter.

The mesenteries were provided with comparatively small oral, but with large marginal stomata. Their mesogloea is rather thick. The longitudinal muscles form no distinct pennons and show, on transverse sections, rather coarse folds, scattered over the whole surface. The parietobasilar muscles are distinctly outlined and reach the region of the marginal stomata. Through the growth of the parietobasilar muscles one part of these muscles becomes mesogloeal as in *Stomphia*. The reproductive organs of specimen 1 are found on the third, on the greater part (18 pairs) of the fourth, and on four pairs of the fifth cycle. In the scheme I have marked the fertile pairs with spaced out figures. The younger sterile pairs, 6 of the fourth order, 32 of the fifth and 8 of the sixth, are very weak, appear only in the most proximal part of the body, and are devoid of filaments. In spec. 2 the third and fourth cycles and 6 pairs of the fifth were fertile. The other pairs of the fifth and sixth cycles were sterile and without filaments.

Genus **Parasicyonis** n. gen.

Diagnosis: Paractiidae with a well developed pedal disc. Body more broad than high. Column thick, smooth, without tubercles. Margin tentaculate without fossa. Tentacles rather short but broad, robust, in contractions wrinkled, the inner longer than the outer. Sphincter comparatively weak, so that the column commonly does not cover the tentacles. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. Two deep siphonoglyphes. Numerous perfect mesenteries. Mesenteries often a little irregularly arranged, both mesenteries of the last sterile cycle sometimes differently developed, so that one mesentery is perfect, another not, but not regularly arranged as in *Actinostola*. Number of mesenteries at least twice as large as that of the tentacles. Only the mesenteries of the last cycle fertile. These mesenteries do not reach the oral part of the column and are, like all the other mesenteries, provided with well-developed filaments.

The genus *Parasicyonis* is certainly nearly related to *Sicyonis*, from which it is mainly distinguished through the fertile mesenteries having well-developed filaments with ciliated streaks, while in *Sicyonis* they are devoid of such, though they are sometimes rather well developed. Also the arrangement of the mesenteries seems to be different in both genera. Possibly it may later on be found out that they may be placed together to a genus, for the present I consider it the most practical to separate them. Excepting the type, *P. sarsii*, I place to the genus also *P. actinostoloides* and *P. maxima*, described by Wassilieff (1908) as belonging to the genus *Cymbactis*. The whole of their exteriors namely recalls that of *P. sarsii*, and the imperfect description, given by Wasilieff, in no way contradicts that we have to do with specimens of the genus *Parasicyonis*. According to me, the following specimens belong to the genus:

Parasicyonis sarsii Carlgr.
— *actinostoloides* (Wassil.) Carlgr.
— *maxima* (Wassil.) Carlgr.

Parasicyonis sarsii n. sp.

Pl. 3. Fig. 12.

Diagnosis: Sphincter reticular, thin but rather long, often in the outer parts with traces of stratification. Tentacles commonly 86 to 103. About one half of the oral disc devoid of tentacles. Radial muscles of the oral disc interrupted at the insertions of the mesenteries, strong. Number of mesenteries about twice as many as the tentacles, or more. Mesenteries of the three first cycles and one part of the fourth perfect. Part of these latter consisting of a perfect and an imperfect mesentery. Arrangement of the mesenteries hexamerous but not regular. Longitudinal muscles of the mesenteries rather weak. Parietobasilar muscles broad, but weak. Nematocysts in the ectoderm of the tentacles numerous (26)29—43 × 2—2,5 μ, in that of the actinopharynx 19—29(37) × 2 (1,5—2 μ). Spirocysts of the tentacles (14 × 1,5) 22 × 1,5—67 × 3,5—4,5 μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx 23—31 × 3,5—4,5 μ.

Colour: pale brick-red, shading off into orange (spec. from Drontheimfiord, Carlgren).

Dimensions of the two largest specimens: length 4 cm, breadth of the pedal disc 8 cm, length of the inner tentacles about 2 cm, the outer not half as long as the inner. The smallest specimen (with only 62 tentacles) is about 2 cm high and 4 cm broad at the pedal disc.

Occurrence: Norway. Finmark Andenes 100—200 fms. (H. Kier 1894) 1 sp., Drondtheim fiord, Garten 250 m (1910) 1 sp., Rødberg 200 m 2 sp., Tautra 250—80 m 2 sp. (»Gunnerus« 1921).
62°18′ N. 4°14′ E. 370 m (Michael Sars-Exp. 1902 St. 60) 1 sp.
62°54′ N. 9°13′ W. 460 m. Bottom temp. 4,37° (Michael Sars-Exp. 1902 St. 101) 2 sp.
15 miles E. of the northernmost Faroe Islands (taken with a line) (Michael Sars-Exp. 24. 7. 1900?) 1 sp.
S. of Iceland 63°15′ N. 22°23′ W. 326—216 m (Thor-Exp. 1903 St. 171) 1 sp.

Exterior aspect. The wide pedal disc is somewhat broader than the column. The body is, in comparison to the breadth, low and forms a short cylinder. The column is smooth, firm and thick, sometimes with indistinct furrows, probably arisen by contraction. The margin is tentaculate without a fossa. The tentacles are thick, robust and conical, in contracted state longitudinally and transversally wrinkled, the inner are more than twice as long as the outer and in preserved specimens about half as long as the height of the column. They are not swollen at the base and rather scattered, so that they occupy about one half of the oral disc. The number varies between 62 in the smallest specimen and 103 in the largest. Five examined specimens had 62, 86, 90, 96, 103 tentacles, arranged in several cycles. In four of the specimens the tentacles were wholly visible, in the smallest specimen and in one of the largest the tentacles were partly covered by the column. It is, however, questionable, if the tentacles may be totally covered, as the sphincter is weak, in comparison to the size of the animals. The inner, tentacle-lacking part of the oral disc is provided with radial furrows. Both siphonoglyphes are broad and deep and aborally a little prolongated. The actinopharynx is long and provided with numerous longitudinal furrows.

Anatomical description: The ectoderm of the column was for the greater part lost. It is thin and contains nematocysts, 17—22 × 1,5 μ in size. I have here, besides, found some nematocysts of the same size as those of the tentacles, but it is possible that they are fastened to the surface and thus not belonging to the column. The mesogloea, especially in some specimens, reaches a considerable thickness and shows a fibrillar structure with scattered, rather numerous, small cells. The sphincter is rather weak and somewhat elongated, but thin and only occupying part of the mesogloea. It was in two examined specimens, in all places reticular with small meshes, in the specimen from Andenes and from Station 60 the outer parts bore traces of stratification; the inner reticular part is separated from the outer by a longitudinal, rather thick mesogloeal lamella. The ectoderm of the tentacles is rather high, though not as thick as the mesogloea, and contains very numerous nematocysts. The size of the nematocysts and spirocysts was in the different specimens as follows. a) typical nematocysts, b) nematocysts with discernible basal part to the spiral thread.

Habitat	Tentacles nematocysts	Tentacles spirocysts	Actinopharynx a	Actinopharynx b
1. Andenes	34—42 × 2,5 μ	24 × 2—67 × 3 μ	19—26 × 2 μ	26—31 × 3,5—4,5 μ
2. S. of Iceland	29—41 × 2	22 × 2—60 × 4,5	22—26 × 2	26—29 × 3,5—4,5
3. St. 101 "M. Sars"	31—38 × 2(2,5)	22 × 1,5—62 × 3,5	22—26 × 1,5—2	24—26 × 4
4. St. 60 "M. Sars"	(26)34—41 × 2,5	14 × 1,5—58 × 3	24—29 × 2	23—29 × 3,5—4,5
5. E. of Farø Isl.	36—43 × 2	24 × 1,5—58 × 3	25—37 × 1,5—2	26—31 × 3,5

In the specimens 1, 3, 4, 5 I have found solitary typical nematocysts in the actinopharynx. They were a little larger (29—38 × 2,5 μ) than usual. Whether these nematocysts belong to the actinopharynx or are sticking to it, I cannot with certainty decide, in specimen 5 I observed only a few typical nematocysts in the maceration preparations, in the other specimens the nematocysts, put down in the table, were, however, numerous. The mesogloeal, longitudinal muscles of the tentacles on transverse sections show meshes of ordinary size, which are situated now in the middle of the mesogloea, now nearer to the endoderm. In the textfig. 198 I have reproduced a transverse section of a tentacle; the muscles are weaker on the outer side than on the inner one. The radial muscles of the oral disc recall the longitudinal muscles of the tentacles. They are the best developed in the specimens 1 and 5 (textfig. 199). They are distinctly interrupted at the insertions of the mesenteries.

Fig. 198

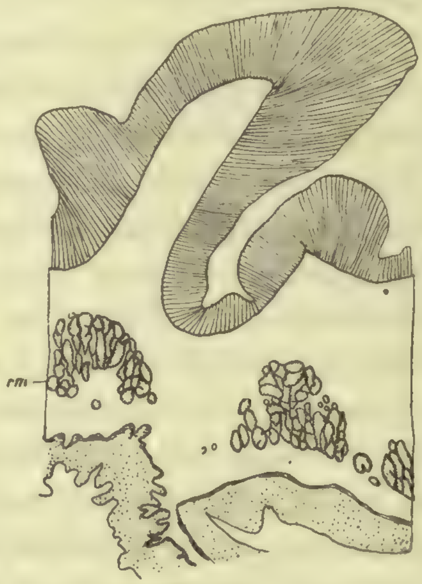


Fig. 199

Textfigs. 198—199. *Parasicyonis sarsii.*
Transverse sections of tentacle (fig. 198) and of oral disc (fig. 199).

The number of mesenteries varies. In one half of specimen 1 with 96 tentacles I counted 54 pairs of mesenteries (27 pairs sterile and as many fertile), in specimen 2 with 90 tentacles the pairs of mesenteries were 94 (22 on one side and 25 on the other, sterile and as many fertile), in specimen 4 with 62 tentacles probably 90 pairs of mesenteries half of which sterile, in the specimen 5 with 86 tentacles 86 (18 pairs on one side and 25 on the other, sterile and as many fertile). As we see, the arrangement of the mesenteries was different on both sides of the directive plane. In one half of specimen 1 the mesenteries of the first to the third cycles were perfect, among the mesenteries of the fourth cycle three pairs reached the actinopharynx, six pairs consisted of a perfect and an imperfect mesentery and three pairs were imperfect like the mesenteries of the fifth and sixth orders. In specimen 4 there were in the whole animal probably 26 pairs perfect and three pairs consisted of a perfect and an imperfect mesentery. In specimen 5 I observed on the less developed side eleven pairs perfect and three consisting of a perfect and an imperfect mesentery, on the other side probably thirteen pairs perfect and four pairs consisting of a perfect and an imperfect mesentery. The pairs, showing a different development of both their mesenteries are, as far as I can see, irregularly arranged. Half the mesenteries are sterile, the other half fertile, the latter are the younger and have well-developed filaments with ciliated streaks like the other mesenteries, but never reach the distal part of the column.

The longitudinal muscles of the mesenteries are rather weak and hardly show any distinct pennons. The parietobasilar muscles are broad and reach far upwards, but consist of a non folded muscle lamella. Oral stomata are present. In two specimens I have also observed marginal stomata, but they do not seem to be constant. The ciliated streaks are well developed.

Genus Sicyonis R. Hertw.

Diagnosis: Paractiidae with well developed, enlarged basal disc and from rather thick to thick, cartilaginous, smooth column, which, in contracted state, is sometimes somewhat sulcated in the upper part and here capable of involution. Sphincter weak or rather well developed. Tentacles short, the inner considerably stronger than the outer ones, often more or less thickened on the outside of the base and in that case with the longitudinal muscles stronger on the inner, weaker on the outer side or disappearing at the base, only about half as numerous as the mesenteries. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. 2 broad siphonoglyphes. The arrangement of the mesenteries is not as regular as in *Actinostola*, variable, but with a strong tendency to a different development of the two mesenteries in the same pair. Often 16 pairs of perfect mesenteries, a variable number of pairs, in which one mesentery is perfect, the other not. Mesenteries with no distinct longitudinal pennons. Parietobasilar and basilar muscles well-developed. Mesenteries differentiated into stronger sterile mesenteries with well developed filaments and into weaker fertile without filaments, the latter appear at the limbus and grow from here in oral direction but do not reach the most distal part of the column.

Among the species described below, *Sicyonis tuberculata* and *ingolfi* are nearly allied to the type-species *Sicyonis crassa*. The agreement is so perfect in important characters, as f. inst. in the presence of mesogloeal muscles in the tentacles and in the oral disc, in the arrangement of the reproductive organs on filament-lacking mesenteries of the last order, in the number of tentacles in comparison to that of the mesenteries etc., that there is no doubt that my species belongs to this genus. It is true, that the tentacles of *Sicyonis crassa*, according to Hertwig, seem to be much more reduced than in my species, but this difference is, however, to my mind, only apparent, as the strong contraction and the bad preservation[1] in connection with a flattening of the tentacles in *S. crassa* have produced the tubercle-shaped appearance of the tentacles in the type. Thus it is to be supposed that the tentacles of *S. crassa* have had about the same appearance as those of *S. tuberculata* and *ingolfi*. Also the large apertures in the apex of the tentacles in the type are certainly artificial products, due to bad preservation (compare further *S. variabilis*). Though *Sicyonis variabilis*, described below, differs from the above named species in the arrangement of the mesenteries, it seems to me that this species manifestly belongs to this genus. To the genus *Sicyonis Cymbactis gossei*, described by Stephenson (1918 b p. 123), probably also may be referred. The whole organisation namely indicates that we have to do with a *Sicyonis*, unfortunately Stephenson does not mention whether the fertile mesenteries are devoid of filaments or not. Concerning the other species of *Cymbactis*, *C. selaginella*, described by Stephenson (1918 a), may be a *Stomphia*[2] (compare this genus), and *C. actinostoloides* Wasil. and *C. maxima* Wasil. belong to the genus *Parasicyonis* (compare p. 208).

R. Hertwig 1888 has described a new species *Sicyonis elongata*. I cannot, however, arrange this species in the series of *Sicyonis*, on account of the comparatively small breadth of the pedal disc and the presence of fertile mesenteries in the distal part of the body instead of in the proximal part, as in the real *Sicyo-*

[1] The Actinians from the Challenger-Expedition are generally very badly preserved and their original shape often greatly altered by the pressure, of which I have been able to convince myself during a visit in London 1897.

[2] After this was written Stephenson (1920 l. c. p. 559) has come to the same conclusion.

nis-species. Manifestly a reversed case takes place, compared with *Sicyonis*, here we find the mesenteries to be more numerous in the distal than in the proximal part, there they are more numerous in the proximal part, here we probably find a greater number of tentacles, corresponding to the richer development of the mesenteries in the distal body-end, there fewer tentacles in number, corresponding to that of the sterile mesenteries. The arrangement of the mesenteries is, besides, so imperfectly known that we cannot with certainty place this species in the vicinity of the genus *Sicyonis*, though much in Hertwig's description speaks for it. For the present I should like to propose a new genus *Synsicyonis* for *Sicyonis elongata*, which I provisionally characterize as follows:

Paractiidae with the basal disc not enlarged. Column thick, cartilaginous, smooth. Sphincter, tentacles, oral disc and siphonoglyphes as in *Sicyonis*, the number of tentacles, however, about the same as that of the mesenteries. Arrangement of the mesenteries probably recalling that of *Sicyonis* (or of *Actinostola?*) but irregular "owing to the alternation of isolated genital mesenteries with isolated complete ones." Mesenteries differentiated in stronger sterile and weaker fertile ones, the latter only in the distal part and without filaments.

According to me, the following species may be referred to the genus *Sicyonis*:

S. crassa R. Hertw.
S. gossei (Steph.) Carlgr.
S. tuberculata Carlgr.
S. ingolfi Carlgr.
S. variabilis Carlgr.

Sicyonis tuberculata n. sp.

Pl. 3. Figs. 2—3.

Diagnosis: Body, according to the different state of contraction, flat or more cylindrical, commonly not high. Sphincter rather well developed, sometimes weak with groups of small meshes, encircled by stronger stripes of mesogloea. Tentacles about 64 to 68 with very strong, swollen mesogloea on the base of the outside. Apertures in the apex of the tentacles small. Longitudinal muscles of the tentacles on the inner side divided in closely packed, but large, meshes, on the outer side considerably weaker and disappearing at the base. Radial muscles in the outer part of the oral disc developed as on the inner side of the tentacles, interrupted at the insertions of the mesenteries. Actinopharynx longitudinally sulcated. Siphonoglyphes very elongated towards the aboral end. Pairs of mesenteries about 64—68, of which one half stronger, sterile and with well developed filaments and longitudinal muscles, the other half alternating with these latter, with weak muscles, fertile, generally without filaments, and extended only in the proximal parts of the body, from which they reach a longer or shorter way upwards, in as much as the reproductive organs are more or less developed. Commonly 16 pairs of perfect mesenteries. The rest of the filamentous pairs often symmetrically arranged on both sides of the directive plane, but the arrangement is not regular as some mesenteries of one and the same cycle arise earlier in certain exocoels than in others. Mesenteries of the pairs mostly differently developed, some of them reaching the actinopharynx with only one mesentery of each pair. Longitudinal muscles of the mesenteries diffuse. Parietobasilar muscles differentiated, much expanded on the mesenteries. Basilar muscles with rather numerous, closely packed, high folds. Oral stomata present. Marginal stomata as a rule on the stronger mesenteries. Nematocysts in the ectoderm of the tentacles 19—34 × 2,5 μ, in the actinopharynx 24—31 × 2,5 μ, here also nematocysts with discernible basal part to the spiral thread 24—29 × 5 μ. Spirocysts in the ectoderm of the tentacles of variable size 22 × 2 to 55 × 5 μ.

Colour in alcohol white, oral disc brown, actinopharynx dark brown.

Dimensions of the largest specimen. Length 4 cm, breadth 4,5 cm.

Occurrence: Davis Strait. 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3,9°. (Ingolf-Exp. St. 32) 8 spec.

Danmark Strait. 64°34′ N. 31°12′ W. 1300 fms. Bottom temp. 1,6°. (Ingolf-Exp. St. 11) 4 spec.

Exterior aspect: The form of the body varies rather considerably, according to the different state of contraction of the animals, now it is strongly flattened (Pl. 3 fig. 2) now more cylindrical (Pl. 3 fig. 3). The pedal disc is wide, the column smooth and irregularly sulcated, in the uppermost part, in certain specimens, with longitudinal furrows, surpassing the limit of the mesogloeal bridges of the tentacles. Neither a fossa nor a distinctly marked margin are present. The tentacles on the outside display very large thickenings of the mesogloea, prolonged far upwards. The distal part of the tentacles is conical or cylindrical with a small aperture in the apex. In some tentacles the apertures are very large, but they are artificial, due to bad preservations. The tentacles are about 64 to 68, arranged in several cycles and thinly scattered. Owing to the strong contraction of the animals I have not been able to determine their arrangement. The tentacles may be totally covered by the column. The oral disc is wide, provided with radial furrows and, in the state with involved tentacles, strongly excavated. The greater part of the oral disc bears tentacles. The actinopharynx is not long, longitudinally sulcated and provided with two broad, symmetrically placed siphonoglyphes. These latter have well developed aboral prolongations and in the oral region two distinct gonidial tubercles.

Anatomical description. The ectoderm of the column is almost totally lost in all specimens. In a specimen there remain just above the pedal disc some fragments, containing very numerous nematocysts, 17—19 × 2 μ large; the mesogloea was very thick, cartilaginous and unequally structured in the outermost and in the inner parts. The former is namely provided with numerous cavities, containing cells, while the latter are of more typical appearance with scattered protoplasma-poor cells. Unfortunately I cannot give a good description of the former as the mesogloea was not well preserved.

The endodermal circular muscles are rather weak, the mesogloeal sphincter of some specimens rather strong, of others, as well as of the largest specimen, weak. In the latter case it only occupies a small part of the breadth of the mesogloea, in the former it is about half as broad as the mesogloea. Also in one and the same specimen the strength of the sphincter may vary in different parts, possibly owing to a different contraction of the tissue. The sphincter is rather elongated and gradually passing into the circular muscles of the endoderm. It is close by the endoderm and shows no distinct longitudinal stratification, though the muscles seem to have been enclosed in the mesogloea during different periods. The meshes are small and arranged in groups, surrounded by somewhat broader balks of the mesogloea (textfig. 201, transverse section of sphincter in its middle part). The ectoderm of the tentacles is on the base of the outside low, on the inside a little thicker, more upwards the ectoderm of the outside is also thicker. It contains rather numerous to numerous nematocysts, 19—34×2,5 μ large, and very numerous spirocysts of variable length, from 22 × 2 to 55 × 5 μ (3 specimens examined). The tentacles are devoid of longitudinal muscles on the abaxial side at the base, more upwards there are solitary muscle-meshes in the mesogloea (textfig. 200, transverse section of tentacle near its base), and in the distal part, above the swelling of the mesogloea, numerous meshes of the same size as those at the adaxial size, where the muscle-meshes are numerous also at the base. The muscle meshes are more or less delicate and often elongated in radial direction. The mesogloea is considerably thicker than the ectoderm, excepting at the apex of the tentacles. The radial muscles of the oral disc recall the outer tentacle-lacking parts of the longitudinal muscles of the tentacles and form thin meshes, elongated in the direction from the ectoderm to the endoderm. At the insertions of the mesenteries they are interrupted by thicker mesogloeal balks. In the vicinity of the actinopharynx the muscle meshes are small and few. The ectoderm of the actinopharynx is rather high, strongly pigmentous and contains numerous, typical nematocysts, 24—31×2,5 μ in size, and rather numerous nematocysts with discernible basal part to the spiral thread (size 24—29×5 μ. 3 specimens examined).

Textfigs. 200—201. *Sicyonis tuberculata.* Transverse section of tentacle near its base (fig. 200) and of the middle part of the sphincter (fig. 201).

Fig. 200

Fig. 201

The arrangement of the mesenteries is rather peculiar and shows a tendency to an octomerous development, in as much as often 16 pairs are perfect; there are besides some fewer or more numerous pairs, of which one mesentery is perfect, the other not. We also often may find several imperfect pairs of mesenteries of which one mesentery is more strongly developed than its partner. I have, however, not made any observations, definitely proving the mesenteries to be arranged, according to the same distinct law as in the Actinostolids, though the mesenteries on both sides of the directive plane are often symmetrically grouped. Five examined specimens show the following arrangement of the stronger mesenteries. Issuing from one directive mesentery we follow the mesenteries as the figures on a dial and, if necessary, call the mesentery next to the directive mesentery *a*, its partner *b*. (The reproductive mesenteries are not enumerated in the scheme).

The following pairs of mesenteries were perfect in:

Sp. 1 (St. 32)
Sp. 2 (St. 11) } 1, 3, 6, 7, 9, 12, 13, 15, 17, 19, 21, 22, 25, 27, 28, 31 = 16 pairs (textfig. 202 *B*).
Sp. 3 (St. 11)
Sp. 4 (St. 11) 1, 3, 6, 7, 9, 12, 14, 16, 18, 20, 22, 24, 27, 29, 30, 33 = 16 pairs (textfig. 202 *A*).
Sp. 5 (St. 32) 1, 3, 6, 7, 9, 12, 13, 15, 17, 19, 21, 22, 26, 28, 32 = 15 pairs (textfig. 202 *C*).

As we see, in specimens 1—3 the same pairs of mesenteries are perfect. In specimen 5 we find mainly the same arrangement of the mesenteries. At the end of one half, the arrangement of the mesenteries is, however, disturbed by an extra filament-bearing mesentery 25 being intercalated. Besides, one of the pairs of mesenteries, which are perfect in specimens 1—3, does not reach the actinopharynx here. The specimen has only 15 perfect pairs. In specimen 4, which is provided with 34 stronger pairs of mesenteries instead of 32 as in specimens 1—3, part of the perfect pairs of mesenteries are of another number than in the latter specimens. If we imagine that the also here developed extra-mesenteries (x) had not arisen, the arrangement of the perfect pairs of mesenteries would be the same as in the three first specimens.

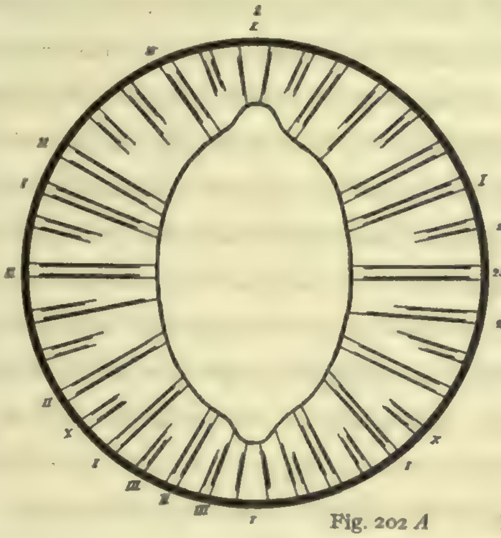


Fig. 202 *A*

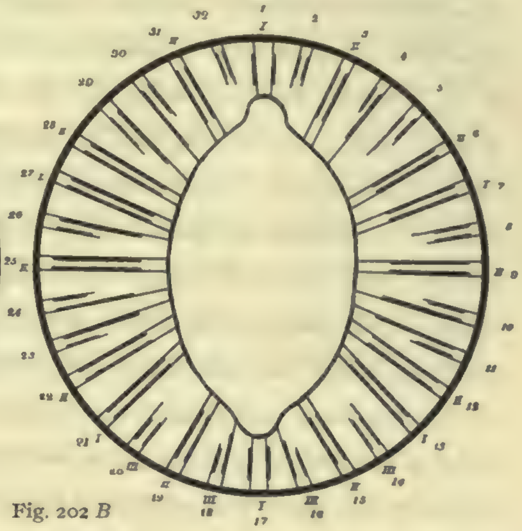


Fig. 202 *B*

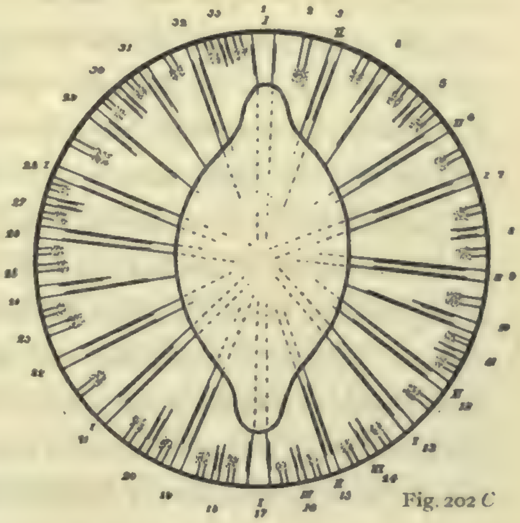


Fig. 202 *C*

Textfigs. 202 *A*, *B*, *C*. *Sicyonis tuberculata*. Diagrams of the arrangement of the mesenteries. In figs. 202 *A* and *B* only the sterile mesenteries are reproduced. Compare the text!

The following pairs of mesenteries consist of a perfect and an imperfect mesentery. The letter indicates the perfect mesentery.

Sp. 1.	4b		10b	11a	16b		18a		23b	24a	26b	29b	30a	= 10 pairs	(202 *B*)
Sp. 2.	4b	8a	10b		16b		18a		23b		26b		30a	= 8 —	
Sp. 3.	4b		10b		16b		18a			24a			30a	= 6 —	
Sp. 4.	4b		10b			17b		19a			26a			= 5 —	(202 *A*)
Sp. 5.	4b		10b							24a		29b	31a	= 5 —	(202 *C*)

The three first specimens as well as the greater part of the specimen 5 fully agree. It is true that the same mesentery is not always perfect, owing to the different number of the pairs, consisting of an imperfect and a perfect mesentery which are present in the five specimens, but it is the same a and b mesenteries which are perfect in the pairs. Now one pair, now another thus seems to grow more rapidly. Besides, it ought to be observed that also several pairs of imperfect mesenteries show a different development of both mesenteries in one and the same pair. So the perfect mesentery 8 a in the specimen 2 corresponds to a stronger imperfect mesentery 8 a in the specimen 1. The perfect mesentery 11 a in the specimen 1 is adequate to a stronger imperfect mesentery 11 a in the specimen 2, and this is also the case with the mesentery 24 a. If we disregard the presence of the extra pairs of mesenteries x (compare above) in the specimen 4, the arrangement of the mesenteries is also here the same, 17b corresponds to 16b, 19a to 18a, 26a to 24a.

How this peculiar arrangement has arisen, is difficult to decide. As to the place of the mesenteries of the first order I think that I am able to draw a definite conclusion. An examination of the expansion of the mesenteries on the pedal disc in four specimens namely distinctly shows, where the mesenteries of the first cycle are situated. On the textfigures 202 *A—C* I have marked these mesenteries with I. On closer examination of these textfigures we find that in two primary exocoels of the first order, one on each side of a directive pair, one pair of mesenteries of the second order (II) and two pairs of the third (III) have been developed (the fertile mesenteries are not included), while the mesenteries are more numerous in the other primary exocoels. In these latter I cannot with certainty determine which mesenteries belong to the second cycle. It is, however, worth noticing that the mesenteries are equally situated in all these four primary exocoels. For my part, I am still inclined to suppose that the mesenteries of the second order have been doubled in these four exocoels. Under this supposition the perfect pairs of mesenteries would consist of 6 pairs of the first and 10 pairs of the second order. If this supposition is correct, the arrangement of the mesenteries namely may be parallelled with that of the Actinostolids. On the above reproduced textfigures the different development of both mesenteries of one pair of the mesenteries of the second order is not discernible at the actinopharynx, which, on the other hand, is the case at the pedal disc. On the textfigure 202 *C* I have designated the approximate extension of the stronger mesenteries on the pedal disc with spaced-out lines. The mesenteries of the first order reach the nearest to the centre of the pedal disc, the directive pair which is turning downwards on the figure is shorter than the five other pairs. In the remaining pairs—which we suppose to be of the second order — we see both mesenteries of the same pair differently developed. They follow the rule, characteristic of the Actinostolids, the stronger mesenteries namely turn their longitudinal muscles towards the lateral mesenteries of the first order and towards the directive pair, situated upwards on the figure; viz. towards the oldest mesenteries, the first, second and third couple during the development. From this we may conclude that the double number of mesenteries of the second cycle probably has arisen in the lateral and ventrolateral primary exocoels. Supposing this to be the case, we may also explain the different development of the mesenteries in one and the same pair of the mesenteries of the third cycle. Also these mesenteries namely likewise follow the *Actinostola*-rule, though the development in the many exocoels has become more irregular, probably in connection with the doubling of the mesenteries of the second order. Concerning the latest developed (fertile) mesenteries it ought to be observed that I have not always been able to determine a different size of both mesenteries of one and the same pair, on account of the specimens not being well preserved, the thick mesogloea of the older mesenteries causing some difficulties at the dissection, and the reproductive organs sometimes being so strongly developed that they hide the other inconsiderable parts of these mesenteries (compare below). On the textfigure 202 *C* I have therefore marked the fertile mesenteries as if they were equally developed. I have, however, been able to ascertain that also here sometimes traces of a different development of both mesenteries of the same pair are present. For all these reasons I think that *Sicyonis* is rather nearly related to the *Actinostola* and *Stomphia*.

Alternating with the stronger, generally sterile pairs of mesenteries (32 in the specimens 1—3, 33 in the specimens 5 and 34 in the specimen 4) there is a cycle of fertile mesenteries (fig. 202 *C*), which are now very small and provided with few reproductive products, now longer with very large reproductive products. These mesenteries arise at the pedal disc and grow upwards, but never reach the distal body-end. Exceptionally some of the smallest mesenteries of the third cycle bear reproductive organs. This is the case with the pairs 5 and 29 of the specimen 2, and the pairs 2, 23 and 25 of specimen 5; in the latter specimen they agree with the other fertile mesenteries, in the former they were provided with filaments.

The longitudinal muscles of the mesenteries are well-developed with closely packed, high folds, expanded over the whole surface and not forming pennons. The parietobasilar muscles are well marked, broad in the lower part and reaching far upwards as a narrow lamella, their folds are, however, very weak in the lower part, in the upper part the muscles form an even lamella. The mesogloea is thick in the stronger mesenteries, thin in the fertile. The greater part of the latter is occupied by the reproductive organs, only a little part next to the column is muscular. The muscle folds are also here numerous on the longitudinal muscle-side, so that we may say that the muscles of the fertile mesenteries form a miniature of those of the sterile mesenteries. Oral stomata are present. The stronger mesenteries are also generally provided with marginal stomata. The filaments of the sterile mesenteries are of typical appearance, the ciliated streaks are well-developed. The fertile mesenteries, excepting the above named, are completely devoid of filaments, as far as I can see, which is in conformity with Hertwig's observations of the type-specimen, *S. crassa*. The species is dioecious. The ova are numerous but small.

Sicyonis ingolfi n. sp.

Pl. 3. Fig. 1.

Diagnosis: Body rather low. Column in the uppermost part with longitudinal furrows. Sphincter as in the former species feeble with a tendency to stratification. Tentacles about 68, the outer with large, the inner with weak, abaxial, bulbous thickenings at the base. Apertures in the apex of the tentacles small. Longitudinal muscles of the tentacles and radial muscles of the oral disc as in *S. tuberculata*, only feebler. Actinopharynx and siphonoglyphes as in the former species. Pairs of mesenteries 68, 34 with well developed filaments and rather well developed muscles, sterile, 34 without filaments, fertile, only present in the proximal part of the body. 16 pairs perfect. Both mesenteries of the same pair of the other stronger mesenteries sometimes unequally developed, so that one mesentery is perfect, the other not. Muscles of the mesenteries about as in *S. tuberculata*, but feebler. Oral and marginal stomata present, the latter at least on some of the stronger mesenteries. Nematocysts in the ectoderm of the tentacles 36—41 × 2,5 μ, in the actinopharynx 29—36 (38) × about 3 μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx 26—29 × 5 μ. Spirocysts of the tentacles from 24 × 2 μ to 62 × 4 μ.

Colour in alcohol: white, the actinopharynx uncoloured.

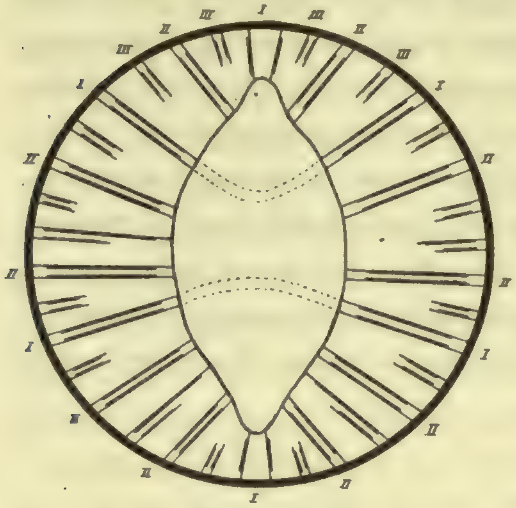
Dimensions in contracted state: Length 3 cm, breadth 4 cm.

Occurrence: South of Greenland. 58°20′ N. 48°25′ W. 1695 fms. Bottom temp. 1°5 (Ingolf-Exp. St. 20) 1 sp.

Exterior aspect. The exterior of this species (Pl. 3 fig. 1) recalls that of *S. tuberculata*. The longitudinal furrows in the uppermost part of the column are more distinct, as in this species. Only the outer tentacles are provided with strong mesogloeal thickenings on the abaxial side, the inner tentacles are also here a little thickened, though by far not as much as in the former species. The tentacles are closer than in

S. tuberculata, wherefore the tentacle-lacking part of the oral disc is large. The actinopharynx is of ordinary length. In the other exterior characters this species agrees with *S. tuberculata*.

Anatomical description: The interior organisation also much recalls that of *S. tuberculata*. The nematocysts are, however, larger, especially those of the tentacles. The ectoderm of the column contains rather numerous nematocysts, 17—22 × 2 μ in size. In the tentacles they reach a size of 36—41 × 2,5 μ and in the actinopharynx 29—36 (38) × about 3 μ. I have in the actinopharynx also observed some nematocysts with discernible basal part to the spiral thread. They are 26—29 × 5 μ in size. The spirocysts of the tentacles vary from 24 × 2 μ to 62 × 4 μ.



Textfig. 203. *Sicyonis ingolfi*. Diagram of the arrangement of the sterile mesenteries.

The arrangement of the mesenteries mostly agrees with that of specimen 4 of *S. tuberculata*. A schematic figure of the arrangement of the stronger mesenteries I have given in textfig. 203. The agroupment of the mesenteries in both the uppermost sextants does not completely correspond with that of *S. tuberculata* nor with that of the middle sextants. The perfect pairs are, however, 16, three pairs consist of one imperfect and one perfect mesentery. Both mesenteries of the imperfect pairs do not differ so much in size as the former species. I have been able to determine with certainty the position of the mesenteries of the first cycle (on the figure designated with I). The four lateral pairs of mesenteries were namely at the base united with each other, two and two (on the figure designated with spaced-out lines), while all other mesenteries, excepting the directives, do not reach so far towards the centre of the pedal disc. The 10 pairs of the second order (II) show the same expansion on the pedal disc as in *S. tuberculata*. The muscles of the mesenteries recall those of the same species, though they are weaker, this is possibly connected with an individual variation, which I cannot decide as I have had only one specimen for examination. The fertile pairs of mesenteries, alternating with the 34 sterile and filament-bearing pairs, were developed only in the proximal part of the body and provided with rather few ova; they were, as in *S. tuberculata*, devoid of filaments.

Sicyonis variabilis n. sp.

Pl. 3. Fig. 11.

Diagnosis: Body in contracted state more broad than high. Sphincter weak, reticular. Tentacles about 70 (67—74) in number, with a thick mesogloea which does not form any basal swellings at the base, cylindrical to conical, in contracted state with irregular, transversal furrows. Longitudinal muscles of the tentacles on the outer and the inner side, at the base, equally developed. Radial muscles of the oral disc interrupted at the insertions of the mesenteries. Actinopharynx ordinarily long. Pairs of mesenteries variable, unto about 100 or a little more. A variable number of perfect pairs (to 21) and a smaller number of pairs, in which one mesentery is perfect, the other not. The arrangement of the mesenteries very variable, unequally developed on both sides of the directive plane. The folds of the longitudinal muscles of the mesenteries as in *S. tuberculata* but not as high. Parietobasilar and basilar muscles and stomata as in *S. tuberculata*. Nematocysts of the tentacles as well as those of the actinopharynx very numerous, the former 31—38 × 2,5 μ, the latter 19—29 × 2 (2,5) μ. Spirocysts of the tentacles very numerous, from 24 × 2 μ to 58 × 4 μ.

Colour in alcohol: uncoloured, actinopharynx brown.

Dimensions of the largest specimen: Breadth of the pedal disc 4,5 × 3,5 cm, height of the body about 2,6 cm, length of the inner tentacles 1,4 cm, that of the outer 0,5 cm. The smallest specimen was 1 cm high and 2,2 × 1,5 cm broad.

Occurrence: 60°37′ N. 27°52′ W. 799 fms. Bottom temp. 4,5° (Ingolf-Exp. St. 78) 9 specimens.

Exterior aspect: The pedal disc is well developed, in contraction wrinkled. The column is like that of the species, described above, sometimes there seems to be an indication of a margin and a fossa, it is, however, probable, that they have arisen by contraction, as in one and the same individual such formations appear in some parts, and are wanting in other parts. The tentacles are from cylindrical to conical, according to the different state of contraction, in contracted state provided with irregular, transverse furrows and devoid of abaxial thickenings at the base. The inner tentacles are at least twice as long and broad as the outer. They are arranged in several cycles, but the agroupment is difficult to decide. The number of the tentacles was in the largest specimen 71, in the smallest 74, and in a third 67. The tentacles occupy the greater part of the oral disc which is provided with distinct, radial furrows. The actinopharynx is longitudinally sulcated, on account of the bad preservation I cannot determine the number of furrows. The siphonoglyphes are distinct and provided with aboral prolongations.

Anatomical description: To judge from the small remaining fragments the ectoderm of the column is low and contains rather numerous nematocysts, about 17 × 2 μ in size. The mesogloea is very thick, fibrillar, with scattered, protoplasma-poor cells. The sphincter is weak, takes up about one third of the breadth of the mesogloea and shows a decidedly reticular structure as in *Stomphia coccinea*. The column, however, seems to be able to cover tentacles, as they were indiscernible in one specimen. The endodermal circular muscles are weak and form low folds. The ectoderm of the tentacles is not particularly thick and contains very numerous nematocysts, 31—38 × 2,5 μ in size, and spirocysts from 24 × 2 μ to 58 × 4 μ. The mesogloeal longitudinal muscles are strong and uniformly developed round about the tentacles and also at the base. The muscle meshes are often elongated in radial direction. The mesogloea is thick. On a longitudinal section (textfig. 204) through the apex of a tentacle the mesogloea was much thinned out about the aperture. If this thin lamella has been torn up by bad preservation, we may easily fancy that the apertures of the tentacles were large. There is no doubt that the large apertures, observed by Hertwig in the tentacles of *Sicyonis crassa*, have arisen through the at the apex very thin mesogloea having been partly macerated by preservation. The radial muscles of the oral disc are very well developed and form closely packed meshes, elongated in the direction from the ectoderm to the endoderm, and interrupted by thick mesogloea-bridges at the insertions of the mesenteries. Its mesogloea is thick, like that of the actinopharynx. The ectoderm of the actinopharynx is rather low, especially in comparison with the mesogloea, and contains very numerous nematocysts: 19—29 × 2—(2,5) μ in size, I have besides observed some larger nematocysts (34—36 × 2,5 μ), which, however, possibly belong to the tentacles.

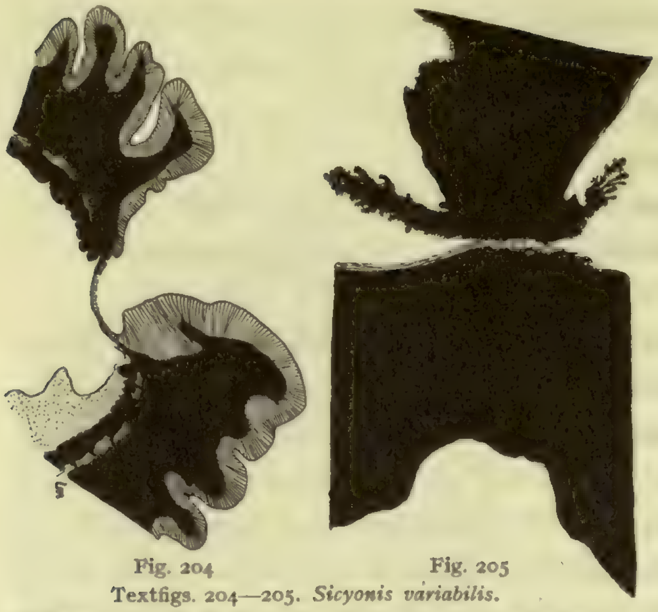


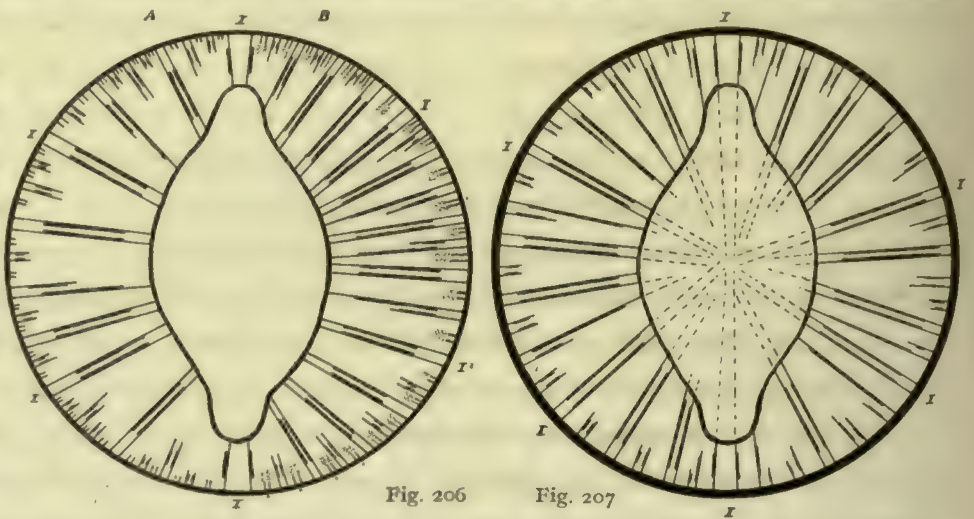
Fig. 204 Fig. 205

Textfigs. 204—205. *Sicyonis variabilis.*

Fig. 204: Longitudinal section of the apex of tentacles.

Fig. 205: Transverse section of the base of a mesentery with basilar muscles.

The arrangement of the mesenteries recalls that of *S. ingolfi* and *tuberculata* but is more irregular. In order to ascertain it, I have examined one whole specimen and half two specimens. The textfigure 206 *A*, *B* shows the arrangement of the mesenteries, each in one half of two specimens, the textfigure 207 that of the third specimen. In *A* and *B* all mesenteries have been drawn, in textfigure 207 the fertile have been left out. In the textfigure 206 *A* the most weakly drawn mesenteries are not provided with longitudinal pennons and reproductive organs, but are certainly future, fertile mesenteries, though the reproductive organs have not yet been developed, owing to the small size of the specimen (the height 1 cm, breadth 2,2 × 1,5 cm). These mesenteries appear only in the most proximal part of the body. I think that I have also in this species been able to determine the mesenteries of the first cycle (I). If we examine the textfigures more narrowly, we find that there are in *A* (in one half of the specimen) 26 stronger pairs of mesenteries, of which 7 pairs perfect and 2 pairs consisting of one imperfect and one perfect mesentery, in *B* 23 sterile mesenteries, of which 11 pairs perfect and 4 pairs built up of imperfect and one perfect mesentery (on the other, not drawn half 10 pairs were perfect and 2 pairs made up of one imperfect and one perfect mesentery). In *C* (fig. 207) we see on one side 21 pairs of sterile mesenteries, of which 9 perfect and 4 made up of one imperfect and one perfect mesentery, on the other side 24 pair, of which 8 perfect and 5 pairs consisting of one perfect and one imperfect mesentery. The arrangement of the mesenteries thus displays great differences, and the mesenteries are not symmetrically grouped on both sides of the directives (compare *B*, *C*). Manifestly, a still greater alteration in the time of appearance of the pairs of the cycles has taken place here than in the other species, whereby some pairs of mesenteries have been checked in their development or wholly suppressed. The perfect pairs of mesenteries are among themselves a little unequally developed, which is seen by their insertion on the pedal disc (on the figure 207 designated with spaced out lines). Also



Textfigs. 206—207. *Sicyonis variabilis.*

Diagram of the arrangement of the mesenteries. In fig. 207 only the sterile mesenteries have been drawn.

in the weaker of the sterile pairs both mesenteries of one and the same pair sometimes are distinctly different in size. This is probably in reality still more commonly the fact than may be concluded from the figure, as an attempt of ascertaining their size meets with the same difficulties here as in *S. tuberculata.*

The arrangement of the mesenteries thus is distinguished from that of the preceding species by its being more irregular, and this irregularity probably (at least in some cases) appearing in all 6 primary exocoels, not only in 4 as in *S. tuberculata* and *ingolfi.*

Alternating with the sterile mesenteries there are weaker, fertile mesenteries (on figure 207 not drawn, on the figure *A*, reproduced specimen, the reproductive organs (in the weakest mesenteries) have not yet been developed). These fertile mesenteries also here arise at the limbus of the pedal disc and grow more or less upwards, they are the least developed in specimen *A*, the most in specimen *B*, in which they reach the region of the actinopharynx.

The longitudinal muscles of the stronger mesenteries form no pennons. but are about equally expanded over the whole surface of the mesenteries. The folds are rather numerous and of ordinary height, they are weakest at the column. On the directive pairs, the folds of which are stronger, the innermost part displays the highest folds. The parietobasilar muscles are in their lower part broad, but rapidly narrowing and proceed upwards as a thin lamella, but do not reach the sphincter. They are not, or somewhat, folded as in the preceding species. The basilar muscles are rather well developed (textfig. 205), though not strong, as they are supported by a thick mesogloea. Oral and marginal stomata are present. Whether the latter, which are often very small, are present on all mesenteries, I have not been able to determine. The ciliated streaks are well developed, and the filaments in the region of the ciliated streaks strong. The sterile mesenteries bear filaments, the fertile are devoid of such. The species is dioecious.

Genus **Actinostola** Verr.

Diagnosis. Paractiidae (Actinostolinae) with the body either short, cup-like, in the proximal part small, in the distal broad, or long cylindrical. Column mostly thick, firm, slightly rugose or almost smooth or with flat tubercles of mesogloeal thickenings, unlobed in the distal part, without verrucae, acrorhagi and fossa. Sphincter in comparison to the size of the body usually rather weak, so that the body-wall, at the contraction of the animal, for the greater part cannot cover the tentacles. Tentacles short, the inner considerably longer than the outer, about as numerous as the mesenteries, hexamerously arranged, in contracted state almost cylindrical, irregularly rugose, sometimes with mesogloeal thickenings at the base of the outside, with mesogloeal longitudinal muscles. Radial muscles of the oral disc mesogloeal. Two well developed siphonoglyphes. Numerous perfect mesenteries, hexamerously arranged. The two mesenteries in one and the same pair, from the third or the fourth cycle, irregularly developed but as a rule outlined, so that the mesentery, which generally turns its longitudinal muscles towards the preceding cycle of mesenteries, is more developed than its partner. Retractor of the mesenteries diffuse. Parietobasilar and basilar muscles strong. Mesenteries of the first and the second order sterile. Reproductive organs first arise on the mesenteries of the third cycle. The fertile mesenteries have filaments.

Actinostola spetsbergensis Carlgr.

Pl. 2. Figs. 3—4. Pl. 3. Figs. 13—15.

Actinostola spetsbergensis n. sp. Carlgren 1893. Pl. 1 fig. 15. Pl. 8 figs. 9, 10. Pl. 9 fig. 1.

— — Carlgr. Kwietniewski 1898 p. 130. Carlgren 1902 p. 46, 1913 p. 1, 1916 p. 3.

— *sibirica* n. sp. Carlgren 1901 p. 481. 1893 b p. 233 fig. 1.

— *walteri* n. sp. Kwietniewski 1898 p. 130. Pl. 14 figs. 4—6.

?*Kyathactis hyalina* n. gen. n. sp. Danielssen 1890. Pl. 1 fig. 3. Pl. 7 figs. 6—9.

Diagnosis: Pedal disc from wide to small. Body generally in contracted state more broad than high, in expanded state cup-like, in contracted more cylindrical. Column longitudinally furrowed, especially in younger specimens, sometimes also with transversal furrows, so that tubercle-shaped elevations arise, sometimes more irregularly wrinkled. Margin rather distinct, capable of involution. Sphincter strongly reticular, sometimes with a little tendency to become alveolar, seldom with traces of stratification. Tentacles hexamerously arranged, in larger specimens about 130—170 in number, the inner considerably longer than the more or less papilliform outer, without thickenings of the mesogloea on the base of the outside; in young specimens smooth, in older, in contracted state, wrinkled or sometimes feebly longitudinally sulcated. Longitudinal muscles of the tentacles and radial muscles of the oral disc expanded over only a part of the mesogloea, and divided in rather fine meshes. Pairs of mesenteries in 5 cycles, the last cycle more or less perfect. Mesenteries of the three first cycles perfect, sometimes only some of the mesenteries of the third cycle are perfect. Mesenteries of the third cycle of different size in every pair, with the longitudinal muscles of the stronger mesenteries generally directed towards the mesenteries of the first cycle. Parietobasilar muscles very strong. Dioecious. Reproductive organs developed from the mesenteries of the third cycle. Typical nematocysts in the distal part of the tentacles 19—31 × 1,5—2,5 (3) μ, in the actinopharynx 22—31 × 2—2,5 (3) μ. Spirocysts in the distal part of the tentacles from 17 × 1,5 μ to about 65 (70) × 4 (5) μ. Nematocysts with discernible basal part to the spiral thread in the actinopharynx 22—32 × 4—5 μ. Often also large stinging capsules in the tentacles, in their distal part from 36 to 50 × 6—7 μ.

Colour: pale reddish-yellow (Michael Sars-Exp. St. 96); pale reddish (Sw. Spitzberg-Exp. 1898). Tentacles pale red (Sw. Spitzberg-Exp. Bremer Sound). *Kyathactis hyalina*: pale rosy-red, the pedal margin yellowish-red, round the mouth a yellowish-red annulus. The tentacles of a somewhat darker rose-colour than the body (Danielssen).

Dimensions: Large specimens unto 2,5—3 cm high and 6—7 cm broad, in contracted state.

Occurrence: New Foundland Bank. 45°53′ N. 51°56′ W. 50 fms. (Ingegerd and Gladan-Exp. 1871).
Rice Strait. 78°45′7 N. 74°56′5 W. 8 fms. (Fram-Exp. 1899). Hafne fiord between 76°25′—76°40′ N and 84°20′ W.—84°45′ W. 2—30 fms. (Fram-Exp. 1900). Gaasefiord 76°44′ N. 88°45′ W. (Fram-Exp. 1901).
North-Greenland. Thule Havn (1914 P. Freuchen).
West-Greenland. Upernivik (Ryder). Nordre Strømfiord 225—230 m. Bottom temp. —0,5° (Nordmann 1911 St. 3 A). Nordre Strømfiord 14—38 m. 400—410 m. (Nordmann 1911 St. 3 B, 4 A). Akudlek (Traustedt). Hol-

stensborg (Traustedt 1892). Godthaab 100 fms. (Ammondsen). Davis strait 66°45′ N. 59°30′ W. (Sofia-Exp. 1883). Davis strait (Holm). 69°17′ N. 52°50′ W. 225 fms. (Tjalfe-Exp. 1908 St. 117—118). 66°44′ N. 56°08′ W. 175 fms. (Tjalfe-Exp. 1908 St. 100). 66°35′ N. 55°54′ W. 88 fms. Bottom temp. 1,6° (Ingolf-Exp. St. 31). 65°17′ N. 54°17′ W. 55 fms. (Ingolf-Exp. St. 34). Bredefiord 170—140 m (Rink-Exp. 1912 St. 156) 110—180 m (Rink-Exp. 1912 St. 91).

Greenland without distinct locality (Wandel 1890).

East-Greenland. Mackenzie bay 12—35 m (Kolthoff-Exp. 1900). Franz Joseph fiord between Bontekoe Isl. and Mackenzie bay 250 m (Kolthoff-Exp. 1900). The sound between Maatten and Renskær 25—50 fms. (Danmark-Exp. 1908 St. 95). Danmark strait 66°42′ N. 26°40′ W. 590 m. Temp. at 550 m 0,11° (Michael Sars-Exp. 1900 St. 13).

N. W. of Iceland. 66° N. 11°41′ W. 280 m (Thor-Exp. 1903 St. 52). Iceland 5 miles o from Seydysfiord 135 fms. (Wandel 1890).

West Spitzbergen. 80°N. 17°5′ E. 40 fms. (Sw. Spitzberg-Exp. 1898). 79°10′ N. 10° E. (Kolthoff-Exp. 1900). Icefiord, Coal Bay 50 m (Kolthoff-Exp. 1900) Gray Hook 60 fms. (Sw. Spitzberg-Exp. 1861). Recherche bay (Klinckowström 1890).

East Spitsbergen. North East Land 79°35′ N. 28′ E. 66 m (Römer & Schaudinn 1898 St. 36). Hinlopen Strait 79°13′ N. 21° E. 80 m (Römer & Schaudinn 1898 St. 44). King Charles Land, Bremer Sound 105 m (Römer & Schaudinn 1898 St. 33), 100—110 m. Bottom temp. —1,45 (Sw. Spitzberg-Exp. 1898 No. 32). Albrecht Bay 13—15 fms. (Kükenthal & Walter). Cap Melcher 45 fms. (Kükenthal & Walter *Actinostola walteri*), Devee Bay 77°23′ N. 21°2′ E. 28 m. (Römer and Schaudinn 1898 St. 8).

Bear Island. 140 m (Michael Sars-Exp. 1901).

75°49′ N. 24°25′ E. 80 m. Bottom temp. —1,42° (Sw. Spitzberg-Exp. 1898). 75°23′ N. 17°45′ E. 110—140 m (Olga-Exp. St. 54). 74°48′ N. 20°54′ E. 80—86 m (Olga-Exp. St. 59). 73°52′ N. 19°55′ E. 130—200 m (Olga-Exp. St. 54). 66°42′ N. 26°40′ W. 590 m. Bottom temp. at 550 m 0,11° (Michael Sars-Exp. 1900 St. 13). 64°58′ N. 11°12′ W. 550 m. Bottom temp. — 0,32° (Michael Sars-Exp. 1902 St. 36). 64°53′ N. 10°0′ W. 630 m. Temp. at 600 m. —0,69° (Michael Sars-Exp. 1900 St. 10).

Coast of Murman. 110—120 fms., 70—80 fms. (Alex. Kowalewsky-Exp. 1909 St.

116, 167 — teste Pax). Pala Guba (teste Pax). Barent Sea 70°21'30 N. 53°50' E. 105 m. (Andrej Perwoswanny-Exp. 1903). W. from Kolgujew 69°14' N. 46°39'30 E. 62 m (Andrej Perwoswanny-Exp. 1903).

Kara Sea. 70°90' N. 64°17' E. 11 fms. (New-Zembla-Exp. 1875) — (Dijmphna-Exp.).

Arctic Sea of Siberia. 20° E. of Cape Jakan 12 fms. (Vega-Exp. No. 60). 69°32' N. 177°41' W. 12 fms. (Vega-Exp.). 67°7' N. 173°24' W. 9—15 fms. (Vega-Exp. No. 185), 2 miles N. E. of the winter station of the Vega 12 fms. (Vega-Exp. 1879).

Behring Sea. 64°34' N. 171°45' W. 25 fms. (Vega-Exp. No. 1061), 63°39' N. 177°5' W. 55 fms. (Vega-Exp. No. 1068).

Exterior aspect: The pedal disc is now rather wide, now of rather small diameter and provided with more or less distinctly conspicuous, radial ridges and furrows, sometimes the central part of it is drawn out in a conical tap as in *Stomphia*. The form of the body varies considerably, according to the state of contraction. Now it is cup-like, now more cylindrical, in preserved specimens the breadth generally is larger than the length, it is rarely the opposite. As the oral disc is wholly unfolded, the distal part is broader than the proximal. In small specimens — such which occur in the coelenteric cavity or in the open sea — the column is provided with distinct longitudinal ridges with deep furrows between. Also in larger specimens traces of these ridges are to be seen. They but rarely appear like a folded longitudinal ribbon; often when the ridges arise, there are also transversal furrows which make the animal look as if it were provided with longitudinal rows of tubercles, such as Kwietniewski 1898 has reproduced *Actinostola walteri*. Sometimes the surface is smooth or irregularly wrinkled. Though no fossa is present, the margin is, however,. rather well marked.The region of the sphincter is sometimes thickened and forms a circular wall, in which case the sphincter is strongly concentrated, owing to the contraction. The tentacles are hexamerously arranged in 6 cycles, the last cycle is, however, as far I have seen, always imperfect. The number of tentacles in several large examined specimens varied between 130 and 170. Kwietniewski declares that *A. walteri* has about 192 tentacles. From his description it seems as if he has not counted them. The inner tentacles are considerably longer than the more or less papilliform outer ones. On very small specimens, as on young in the coelenteric cavity, they are smooth or almost so, on larger specimens they are indistinctly longitudinally furrowed or irregularly wrinkled. They have never any thickenings on the outside of the base. The oral disc is wide, and provided with deep or shallow radial furrows, in contracted state also with circular furrows. The actinopharynx is of ordinary length and longitudinally sulcated, the folds are, however, not as numerous as in the *Stomphia*-species described below, amounting to about 10 on each side of the directive plane. The gonidial tubercles are distinct, the siphonoglyphes very well marked, broad and provided with long aboral prolongations.

Anatomical description: The anatomy of this species has been described by myself 1893 and 1902, and I have but little to add now as my latest examinations have been made on a richer material and mainly verify my former observations. Concerning the stinging capsules, there are in the tentacles typical nematocysts in varying numbers, now numerous, now more sparse, in addition to numerous spirocysts; in one part of the specimens there were large specific nematocysts of the same kind as I have found in the other, below described *Actinostola* species. These capsules were now numerous, now sparse. I at first supposed that I had to do with two different species, one with large specific nematocysts, the other without such, as there is, however, no difference in their structure I must regard these specimens as belonging to the same species, the more so as I have found some specimens, the nematocysts of which were so sparse that it was only after repeated examinations of the maceration preparations that I was able to find one or a few capsules in the tentacles. I cannot decide the cause of this difference in the occurrence of these nematocysts. It may be possible that they have in several cases been lost through preservation, though I must confess that I do not find that explanation satisfactory. In the actinopharynx there are, in addition to typical nematocysts, also some such with discernible basal part to the spiral thread. The size of the nematocysts and the spirocysts in a series of specimens was as follows. *a*: typical nematocysts, *b*: large specific, opaque nematocysts, *c*: nematocysts with discernible basal part to the spiral thread. *spi*: spirocysts.

As wee see, the nematocysts of the different specimens agree well in size, it is therefore probable that the specimens with *b*-nematocysts in their tentacles and those devoid of such belong to the same species. The sphincter also varies a little in appearance. In the type-specimen it was strongly concentrated, in other specimens more elongated, as in *Stomphia*. As we may find a concentrated as well as an elongated sphincter in different parts of one and the same specimen, I think that this difference is due to a stronger or weaker contraction of the mesogloea in the distal part of the column. In the type-specimen the sphincter occupies almost the whole breadth of the mesogloea, which was also the case in several examined specimens. In other specimens the part of the mesogloea, outside of the sphincter, was considerably thicker, this is especially the case in specimens having a thick mesogloea. This difference is probably also connected with the more or less strong contraction of the mesogloea. The sphincter also varies a little in structure. Generally the sphincter is reticular, sometimes, especially in the outermost parts, the meshes are more sparse, wherefore the sphincter here shows a tendency to be alveolar. To judge from the

Habitat	Column	Distal part of the tentacles			Proximal part of the tentacles			Actinopharynx	
		a	*b*	*spi.*	*a*	*b*	*spi.*	*a*	*c*
Greenland	....	19—22×1.5 μ	36—50×6 μ	19×1,5—52×4,5 μ	....	36—50×6 μ	....	....	about 24×4 μ
Davis Str. (Holm)	....	24—26×2—2,5	38—47×7	24×1,5—60×3,5	24—26×2—2,5 μ	38—43×6—7	22×1,5—50×3,5 μ	24—26×2(2,5) μ	24—29×4—5
Tjalfe St 100	....	19—24(26)×1,5—2	38—50×7	19×1,5—53×4,5	17—24×2	38—49×6—7	—55×4,5	22—26(29)×2—2,5	26×4
Nordre Strømfiord	17—19×1.5 μ	19—26×2	41—46×6—7	22×1,5—52×5	24×2	38—48×7	—55×5	22—26(31)×2—2,5	22—26×4—5
Upernivik	....	19—24×1,5—2	41—50×7	22×2—55×5	....	....	....	....	....
Siberia (Vega 185)	....	....	....	....	20—24(31)×2—(2,5)	31—36×5—6	22×1,5—50×3.5	....	24—29×4—5
Recherche Bay (type)	18—19×2	24—31×2,5(3)	absent	19×2—58×5	....	absent	....	24—30×2.5	26—30×5
Ingolf St. 34	....	20—26×2	»	22×1,5—62×3,5	....	»	....	23—26×2,5	24—32×4
— - 124	....	22—26×2	»	17×1,5—55×3	....	»	....	24×2	22—27×4—5
Thule Havn	19—22×1,5—2	21—26×2—2,5	»	22×1,5—58×4	....	»	....	22—24(29)×2	26—30×4
Kara Sea (Dijmphna)	....	25—30×2,5	»	24×2—65×4	20—27×2	»	....	23—30×2—2,5	23—27×4,5-5
Fram-Exp.	....	24—29×2—2,5	»	24×2—55×3,5	22—27×2,5	»	24×2—60×4	22—24×2,5	23—30×4—5
King Charles land 110—115 m.	....	22—27×2,5	»	—70×3,5	....	....	....	22×2	24—29×4—5
Behring Sea	....	23—31×2,5(3)	»	....	....	....	....	24—19×2,5(3)	about 24×4—5
Arctic Sea of Siberia (*A. sibirica*)	....	22—29×2—2,5	»	24×1,5—58×4	....	....	....	22—26×2—2,5	23—30×4—5
A. walteri Kwietn.	16—18(22)	(20)24	?	—60	....	....	....	about 24	....

figure of the sphincter of *A. walteri*, reproduced by Kwietniewski (1898) — a species to my mind identical with *A. spetsbergensis* — the sphincter seems to be almost alveolar. In sexually ripe specimens I have but rarely found traces of stratification in the middle part; this stratification is, however, never as distinct as in *Actinostola abyssorum* and *callosa*.

The mesenteries are arranged as in the type-specimen, which I have been able to confirm by several examined specimens. The longitudinal muscles of the strongest mesentery in the pairs of the third cycle face towards the mesenteries of the first cycle. In a single specimen, of which I have examined one half, two mesenteries deviate from this rule, in as much as the longitudinal muscles face towards the mesenteries of the second order. The appearance of the mesenteries as for the rest agrees with that of the type-specimen. The size of the marginal stomata, however, varies considerably, sometimes they are very large as in the reproduced specimen of *A. sibirica* (Carlgren 1893b p. 233 fig. 1), at other times they are small as in the type-specimen. The ciliated streaks were well developed and the mesogloea of the filaments in the middle part provided with rather numerous cells.

Textfig. 208

Actinostola (Kyathactis) hyalina. Transverse section of sphincter.

The reproductive organs start from the mesenteries of the third order; in a specimen I have, however, found a fertile mesentery of the second order. In a great part of the specimen the ova were large and few, in other parts numerous and smaller. This difference is probably connected with the fact that the reproductive period in the first case had come to its close. I have in several specimens found young in the coelenteric cavity. Sometimes these young reach a considerable size (Carlgren 1893b, 1902 p. 47). The coelenteric cavity thus in this species serves as a brood-room.

As I have before mentioned (1902 p. 47) a parasitic Crustacean, probably *Antheachares dübenii*, sometimes appears in the mesenteries. Sometimes a Nemertin, *Nemertopsis actinophila* Bürger, seems to live symbiotically with this species. From the mouth of a specimen from Coal bay, Spitzbergen such a Nemertin juts out, quite unhurt.

Systematic remarks: As is seen by the list of synonyms, I think that *Actinostola sibirica* Carlgr. and *A. walteri* Kwietn. are identical with *A. spetsbergensis*. The few differences I have found between *A. sibirica* and *spetsbergensis* do not justify the formation of a new species for *sibirica*, as the appearance of the sphincter, of the column and of the stomata may vary. The same is the case with *A. walteri*. Probably *Kyathactis hyalina* Dan. is identical with *A. spetsbergensis* and is only a young of this species; of this I have convinced myself by a comparison of a specimen of this species with young of *A. spetsbergensis*. I reproduce here a transverse section of the sphincter of *Kyathactis* (fig. 208). Upon all accounts, *K. hyalina* is an *Actinostola*-species and nearly related to *A. spetsbergensis*.

Actinostola callosa Verr.

Urticina callosa n. sp. Verrill 1882 p. 224, 315.

Actinostola callosa Verr. Verrill 1883 p. 57 Pl. 7 fig. 2, 1883 b p. 515, 534. Carlgren 1893 p. 71 Pl. 1 figs. 17, 19. Pl. 4 fig. 1. Pl. 8 fig. 3. Pl. 9 figs. 5, 6 textfigures 18, 19. Parker 1900 p. 753 textfig. 11.

— *atrostoma* n. sp. Stephenson 1918 b p. 118 Pl. 14 figs. 5, 7, 8. Pl. 15 fig. 7, Pl. 16 figs. 11, 12, 16—20. Pl. 17 figs. 1—4.

Diagnosis: Body in contracted state cylindrical or somewhat cup-like, generally much more high than broad. Pedal disc not larger than the breadth of the column, in contracted state often excavated. Column thick, cartilaginous, in younger specimens often smooth or with irregular furrows, in larger specimens with tubercle-shaped, rather flat thickenings of the mesogloea in the upper part or over the whole surface. Margin indefinite, often continuous with the base of the outer tentacles, not capable of involution. Sphincter moderately long but narrow, non-concentrated, distinctly longitudinally stratified, reticular to alveolar. Tentacles hexamerously arranged, in large specimens in 7 cycles, rugose, sometimes with rather large thickenings of the mesogloea at the outside of the base, the inner tentacles several times thicker and longer than the outer. These thickenings may appear only on the outer tentacles or on all. Longitudinal mesogloeal muscles of the tentacles and radial muscles of the oral disc of variable size but mostly alveolar. Both mesenteries in the pairs of the third cycle of about the same size. Parietobasilar muscles about two thirds of the length of the column. Dioecious. Reproductive organs on the mesenteries from the third cycle. Nematocysts in the ectoderm of the column (17) 19—24 (29) × 1,5—2 μ, those in the distal part of the tentacles 22—36 × 1,5—2 μ and those of the actinopharynx 22—34 × 2 μ. Spirocysts of the tentacles from 24 × 2 to 72 × 4,5—5 μ. Large stinging capsules in the ectoderm of the tentacles very few (36) 43—51 × 6—8 μ, scarce nematocysts with discernible basal part to the spiral thread, in the actinopharynx 21—26 × 4—5 μ.

Colour generally salmon-coloured or orange, all parts often of nearly the same colour, body-wall almost always pale salmon-coloured or buff, varying to deep salmon-coloured or orange-red with paler tubercles, oral disc most often deep salmon-coloured, or generally of the same colour as the body, but of a darker shade, with paler radii, the large lateral lobes of the lip like the disc, but darker, usually salmon-coloured or orange-brown, the large gonidial grooves whitish or pale yellow, tentacles usually plain deep salmon-coloured or orange-brown, with paler striae or reticulations (Verrill). Body-wall salmon-coloured, shading off a little into blue with yellow-red furrows. Tentacles and the outer part of the oral disc yellow-red, inner part of the disc like the body-wall. Actinopharynx and the gonidial tubercles reddish-brown, especially the upper margin of the actinopharynx (Carlgren). Actinopharynx and the whole ectoderm reddish-brown in alcohol (Michael Sars-Exp. St. 76).

Dimensions: Large specimens often 16 to 18 cm in height, with the expanded disc 20—25 cm broad, larger tentacles about 1,5 cm long and 0,5—0,6 cm broad (Verrill). The largest specimen, observed by myself from the Ingolf-Expedition (St. 65), in contracted state: the expanded oral disc 13 cm, the strongly contracted body-wall 11,5 cm in height. A specimen from Japan: height 12 cm, breadth 8 cm.

Occurrence: East coast of N. America from New-Foundland to Cap Fear 50—640 fms. (teste Verrill).

Baffin Bay. 71°34′ N. 65°55′ W. 306 fms. (Wandel 1880). Davis Strait 66°49′ N. 56°28′ W. 235 fms. (Wandel 1889). 66°35′ N. 56°38′ W. 318 fms. Bottom temp. 3,9° (Ingolf-Exp. St. 32). Kvanefiord S. Greenland 420 fms. (Rink-Exp. 1902 St. 5).

61°33′ N. 19° W. 1089 fms. Bottom temp. 3° (Ingolf-Exp. St. 65).

59°28′ N. 8°1′ W. 1100—1300 m. Bottom temp. at 1000 m. 8,07° (Michael Sars-Exp. 1902 St. 76).

Norway. Finmark Jökel fiord 80—100 m. (Nordgaard). Stönnesbottn 40—80 m (Nordgaard). Drontheimfiord. Dröbak (Carlgren).

Skagerrak. 230—430 fms. (Gunhild-Exp.) 140 m (Thor-Exp. 1903 St. 19).

Sweden. Kosterfiord 210 m (Arwidsson). 220—230 m (Sandberg 1901). Väderöarne. Gullmaren 40—50 m (Carlgren and others.)

S. W. coast of Ireland. 51°36′ N. 11°57′ W., 51°35′ N. 11°55′ W., 51°27′ N. 11°55′W. 540—720 fms. (teste Stephenson *A. atrostoma*).

Further distribution: Japan Kinshin S. off Nagasaki (Bock-Exp. 1914).

Exterior aspect. The exterior of this species has before been described by Verrill, by myself, and by Stephenson. Some of the specimens I have examined, as those from Davis strait, Kvanefiord and the station 65 (Ingolf-Exp.), were provided with rather strong tubercles over the whole surface of the column, while others were tuberculated only in the upper part of the body-wall. It seems as if the specimens, living in deeper waters, are more tuberculated than those, living in shoal waters, my material is, however, too small for deciding this with certainty. The appearance of the tentacles also varies, in as much as all tentacles may be devoid of the mesogloeal thickenings at the base of the outside, as in the specimens from Gullmar-fiord, while several specimens, as those from Baffin bay and Skagerrak, have thickenings only on the outer tentacles, and still others — specimens from the Ingolf-Exp. (St. 65), Michael Sars-Exp. (St. 76), Davis Strait and Kosterfiord (220—230 m) — are provided with such thickenings on all tentacles. Also in the American forms (from Maine bay and Martha's Vineyard) I have observed specimens with and without tentacle tubercles. I must, therefore, regard Stephenson's *A. atrostoma*, in the main proposed on basis of the presence of tentacle tubercles, as identical with *A. callosa*, as the anatomical characters of *atrostoma* agree with those of Verrill's species. I will besides add that the specimens, taken during the Michael Sars-Expedition, perfectly resemble *A. atrostoma*. Thus, to my mind the species shows a distinct tendency to form tentacle tubercles, as it seems, especially in the specimens living in deeper water[1].

Anatomical description. The anatomy of this species has before been sufficiently described by myself and by Stephenson, so that it is unnecessary to discuss it here. I will, however, give an account of the size of the nematocysts and spirocysts in some specimens. *a*: typical nematocysts, *b*: large specific nematocysts, *c*: nematocysts with discernible basal part to the spiral thread, *spi*: spirocysts.

[1] The new genus, *Catadiomene*, proposed by Stephenson (1920) for the *Actinostola*-forms with swellings of the mesogloea at the aboral side of the tentacles, thus must be dropped.

Habitat:	Column *a*	Distal part of the tentacles *a*	*b*	*spi.*	actinopharynx *a*	*c*
Gullmar fiord	19-22×2 μ	29-34×1,5 μ	36-46×7 μ	26×2—60×5 μ	25-29×1,5 μ	24×5 μ
Ingolf-Exp. St. 65	22-24×2	22-34×1,5-2	45-51×7-8	26×2—72×4,5	26-31×2	22-26×5
Michael Sars-Exp. St. 76	—	24-32×2	43-49×6-7	24×2—62×5	25-29×2	21-23×4
Baffin Bay	17-19(29)×1,5-2	26-36×2	46-48×7	—67×4,5	24-29×2	22-26×4
Maine Bay	—	29-36×2	43×7	24×2—70×4,5	22-34×2	22-26×4,5
Rinck-Exp. St. 5	19-22×2	27-36×2	46-50×6-7	24×2—67×4-4,5	24-34×2	22-24×4-5
Japan	—	26-36×2	50-51×7	22×2-65×4,5-5	26-31×2	24×5
Bohuslän (a little young)	—	22-24×1,5	29-41×(5)6	—	—	14-22×3,5

In my description of the species (1893) I have stated that no marginal stomata are present. They may, however, appear, though not regularly.

Remarks. As I have above put forth, I regard Stephenson's *atrostoma* as identical with *A. callosa.* On the other hand, I have not added Hertwig's *Dysactis crassicornis* to the list of synonyms. It is true that it is very nearly related to *A. callosa*, but it has a much stronger sphincter and a thinner column than the real *A. callosa*, which I have ascertained by examining one of the type-specimens. At present I dare not place these two species together. In contradistinction to Mc. Murrich (1893) and Rees (1913), who think that they are identical, I have not added the species from the West coast of North America, described by Mc. Murrich as *A. callosa*, either. Probably this species is the same as Hertwig's species. That *A. callosa* nevertheless has a large distribution, is proved by its occurrence at Japan.

Actinostola abyssorum (Dan.) Carlgr.

Bunodes abyssorum n. sp. Danielssen 1890 Pl. 3 fig. 3. Pl. 10 figs. 8—9.

Actinostola abyssorum n. sp. Carlgren 1893 Pl. 1 figs. 5, 10. Pl. 8 figs. 1, 2, 7, 8, 11. Pl. 9 fig. 4 textfigs. 14—17.

Diagnosis: Pedal disc wide, of about the same breadth as the length of the body. Column thick-walled with longitudinal and transversal furrows, whereby tubercle-shaped thickenings arise, which are the largest at the middle. Margin as in *A. callosa.* Sphincter long, but narrow, not concentrated, distinctly stratified, reticular, forming very thin meshes. Tentacles to about 300, hexamerously arranged, conical, irregularly wrinkled, with distinct orifice at the apex, not bulbously swollen at the base, the inner considerably broader and longer than the outer. Longitudinal mesogloeal muscles of the tentacles and the greater part of the mesogloeal meshes of the oral disc are very finely divided. Both mesenteries in the pairs of mesenteries of the third cycle of about the same size. Parietobasilar muscles strong, almost reaching the proximal end of the sphincter. Marginal and oral stomata present. Dioecious. Reproductive organs on the mesenteries from the third cycle. Nematocysts of the column 22—26 × 1,5—2 μ, those of the distal part of the tentacles 32—38 × 1,5 μ and those of the actinopharynx 24—31 × 1,5 (2) μ. Spirocysts of the tentacles from 17 × 1,5 μ to 65 × 5 μ. Large stinging capsules in the tentacles very sparse 48—53 × 5—6 μ, scarce nematocysts with discernible basal part to the spiral thread in the actinopharynx 24—27 × 4,5 μ.

Colour. Column white with a mother-of-pearl lustre, shading off into pale reddish or bluish tinges. Tentacles Havana-brown. Oral disc of the same colour as the column, perhaps slightly darker, and from the mouth thin brown stripes radiate towards the tentacles. Oral labiae and actinopharynx dark chestnut-brown (Danielssen).

Dimensions in extended state about 25 cm in height and 20 cm in breadth, in contracted 15 resp. 23 cm (Danielssen). Preserved specimen from Alten fiord: Height 6 cm. Diameter of the pedal disc 7 cm, that of the oral disc 6 cm. Length of the inner tentacles 1,5—1,75 cm, that of the outer 0,5 cm.

Occurrence: 61°10′ N. 6°32′ E. 1229 m. Bottom temp. 6,7° (Norw. N. Atlantic-Exp. St. 2 teste Danielssen). Tanafiord 70°47′ N. 28°30′ E. 232 m. Bottom temp. 2,8° (Norw. N. Atlantic-Exp. St. 261). Altenfiord 183 m (Jägerskiöld 1890).

Remarks: I have now examined a specimen of Danielssen's *Bunodes abyssorum* (from the station 261) and I am able to confirm that this species is identical with *Actinostola abyssorum*, described by myself. The structure of the sphincter, of the tentacles and of the oral disc agrees with that of the same organs of *A. abyssorum* This is also the case with the stinging capsules. Danielssen's description is not good, there are no acontia, no suckers, the sphincter is mesogloeal etc. For a more detailed description compare my paper (1893).

A. abyssorum is nearly allied to *A. callosa*, and it is a question whether this species is really not a variety of *A. callosa*. I have not seen the specimen from the station 2 and cannot decide, whether it belongs to *A. abyssorum* or to *A. callosa*. Concerning *Actinostola abyssorum* Carlgr. (Pax 1915) compare p. 159.

Actinostola groenlandica Carlgr.

Pl. 2. Fig. 10.

Actinostola groenlandica n. sp. Carlgren 1899 p. 33.

Diagnosis: Pedal disc well-developed. Column cylindrical, in contracted state much higher than broad, from rugose to almost smooth, sometimes with indistinct longitudinal furrows, without tubercles, ordinarily thick. Margin rather distinct, probably not capable of perfect involution. Sphincter rather strong, reticular, sometimes with a little tendency to become alveolar and a little stratified. Tentacles hexamerously arranged, in 6 or 7 cycles, in contracted state rugose, the inner longer than the outer papillar ones, without mesogloeal thickenings at the base of the outside. Longitudinal muscles of the tentacles and especially the radial muscles of the oral disc divided into rather fine meshes. Actinopharynx about half or one third as long as the body-wall. Pairs of mesenteries in 5 or 6 cycle, the last (6th) cycle more or less perfect. Mesenteries of the three first orders perfect. Both mesenteries in the pairs of the third cycle about equally developed. Parietobasilar muscles strong, almost reaching the sphincter. Monoecious. Reproductive organs on the mesenteries from the third to the last or to the last cycles but one. The older mesenteries always with ova, the younger with ova and testes, often both testes and ovaries in the same mesentery. Typical nematocysts in the ectoderm of the tentacles 19—27 × 2—2,5 μ and those of the actinopharynx 22—29 × 2 μ. Spirocysts of the tentacles from 22 × 2 μ to about 60 × 4,5 μ. Large stinging capsules in the ectoderm of the tentacles 38—52 × 6—7 μ, nematocysts with discernible basal part to the spiral thread in the actinopharynx 22—29 (32) × 4—5 (6) μ.

Colour?

Dimensions in preserved state: Length of the largest specimen 6,8 cm, breadth of the base about 3,8 cm, the outer tentacles about 0,3 cm long.

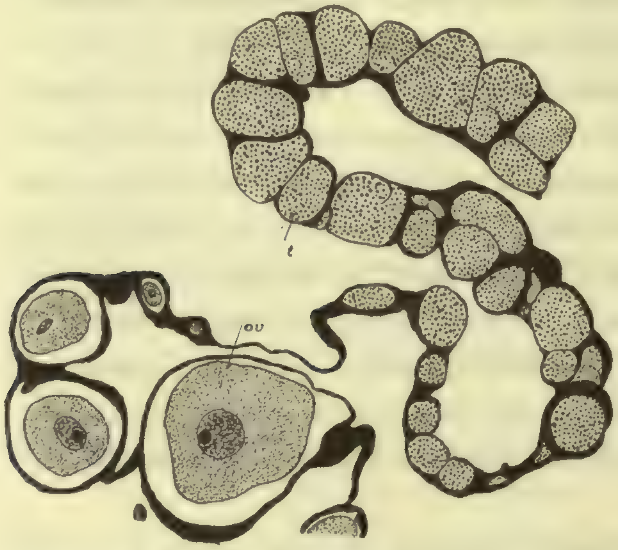
Occurrence: West Greenland. Ritenbenk 15—20 fms. (Öberg). Julianehaab 5—10 fms. (Ammondsen 1865). Davis Strait 60°40′ N. 55°54′ W. 150 fms. (Tjalfe-Exp. 1909). 69°17′ N. 52°50′ W. 225 fms. (Tjalfe-Exp. 1908 St. 117—118).

Greenland without distinct locality.

Exterior aspect. The pedal disc is well developed, though not broader than the diameter of the column. The body is in preserved state cylindrical, in all specimens considerably higher than broad. The column is more or less wrinkled, in one specimen only in the uppermost part, but forms no tubercles. It is comparatively thin, and the insertions of the mesenteries possibly may be seen in wholly expanded specimens; traces of indistinct longitudinal furrows also in preserved specimens are sometimes visible. The margin is rather well marked. The tentacles are hexamerously arranged in 6 or 7 cycles, of which the latter is imperfect and lacking in the smaller specimens. The tentacles are in preserved state wrinkled and devoid of basal thickenings, the inner tentacles are considerably thicker than the outer papilliform ones. No specimen had involved tentacles, and it is a question whether the tentacles may be wholly covered by the column, as the sphincter is comparatively weak, in comparison with the size of the specimens. The oral disc is in contracted state of the animal concave, but not as deeply excavated as in *Actinostola callosa*, and provided with radial furrows, corresponding to the insertions of the mesenteries. The mouth is provided with distinct gonidial tubercles. The actinopharynx is one half or one third of the length of the column and shows longitudinal ridges, amounting to about 10 in its lower part on each side. The siphonoglyphes are very broad and aborally prolongated.

Anatomical description. The ectoderm of the column contains nematocysts, $12—19 \times 1,5—2\ \mu$ in size, and is thin, in comparison to the mesogloea which is of ordinary thickness and less strong than that of *A. callosa*. It is provided with few protoplasma-poor cells. The endodermal circular muscles of the column are well developed. The sphincter is elongated, reticular, sometimes in several parts with a little tendency to be alveolar; in a specimen I have observed a tendency to stratification not far from the distal end. The sphincter generally much recalls that of *Stomphia*, though it is less broad. Outside of the sphincter there is a rather thick, sphincter-free part of the mesogloea, which, however, does not make out one half of the whole breadth of the mesogloea. The ectoderm of the tentacles is high and contains very numerous spirocysts, from about 22×2 to $60 \times 4,5$ and few nematocysts of typical appearance, from 19 to $27 \times 2—2,5\ \mu$. There are, besides, also scattered, large specific nematocysts here, from 38 to $52 \times 6—7\ \mu$. Also in this species they vary in number. In one specimen I found only a single capsule in the maceration preparations, while in the other specimens they were more numerous, though never common. The mesogloea of the tentacles is thick and the mesogloeal muscles form rather small but numerous meshes. The mesogloeal radial muscles of the oral disc are reticular, in the outer part of the disc very strong, and interrupted at the insertions of the mesenteries. The ectoderm of the actinopharynx contains sparse, typical nematocysts, $22—29 \times 2\ \mu$ in size, and nematocysts with discernible basal part to the spiral thread, $22—29\ (32) \times 4—5\ (6)\ \mu$.

The mesenteries are hexamerously arranged in 5 or 6 cycles. The mesenteries of the three first orders are perfect, though those of the third order do not reach as far down on the actinopharynx as both the first. Both mesenteries in the pairs of the third cycle seem to be about equally developed. From the mesenteries of the fourth cycle the mesenteries are distinctly arranged, according to the *Actinostola*-rule. The 12 first pairs of mesenteries are sterile like those of the youngest cycle, sometimes also one part of the last cycle but one. The species is monoecious, and testes and ovaries were simultaneously developed. As far as I have observed, the mesenteries of the third cycle always have ovaries, those of the fourth cycle now ovaries, now testes, sometimes both mesenteries of this cycle are only provided with testes, sometimes the strongest mesentery of a pair has ovaries, the weakest testes. The mesenteries of the fifth cycle as a rule form testes. I have, however, found specimens, in which testes are present only in a part of the mesenteries, while the others have ovaries. The testes, when found, were always numerous. Rather often testes and ovaries may be found in the same mesentery. There is thus a great variation in the distribution of the testes and the ovaries, still it seems, as if the ovaries appear on the older, the testes rather on the younger mesenteries. In the textfig. 209 I have reproduced a transversal section of a part of a mesentery with ovaries (*ov*) and testes (*t*). The ovaries, as well as the testes were well developed; in a specimen, one of the largest of the collection, the reproductive organs were absent.



Textfig. 209. *Actinostola groenlandica.*
Transverse section of part of a mesentery with ovaries and testes.

The longitudinal muscles of the mesenteries form no pennons but are ordinarily developed, the transversal muscles are distinct and the parietobasilar muscles strong, well marked and almost reach the sphincter. The basilar muscles on transverse sections are of about the same appearance as in *A. spetsbergensis*, though the muscle lamella are more extended along the sides of the mesenteries than in this species. I have not observed any marginal stomata; on the other hand, there are commonly oral stomata. I have found small young in the coelenteric cavity of two specimens, in the one specimen they were very numerous. In this respect the species agrees with *A. spetsbergensis*.

Genus **Stomphia** Gosse.

Diagnosis: Paractiidae (Actinostolinae) with well developed basal disc and rather thin to thick, in contracted state rugose body-wall, which is devoid of tubercles, verrucae, acrorhagi, and fossa. Sphincter strong, so that the body-wall may cover the tentacles. Tentacles short, conical, in contracted state wrinkled or longitudinally sulcated, always without thickenings on the outer side, and like the mesenteries arranged after the number 6 + 10 (12) + 16 (18). Inner tentacles longer than outer. Longitudinal muscles of the tentacles and radial muscles of the oral disc mesogloeal. Actinopharynx of ordinary length with two well developed siphonoglyphes. 16 to 18 (6 + 6 + 4 (6)) pairs of mesenteries perfect, the last cycle of these latter often consisting of a perfect and an imperfect mesentery. Most mesenteries confined to the proximal part of the body. At least the younger mesenteries developed according to the rule of *Actinostola*. Parietobasilar and basilar muscles well developed. Perfect mesenteries generally sterile; when the perfect pairs are more than 16, the exceeding pairs are often fertile, the weaker mesenteries of the third cycle also often fertile. At least the stronger imperfect mesenteries fertile. The fertile mesenteries have filaments.

The genus *Stomphia* is on one side nearly related to *Actinostola*, on the other side it recalls *Sicyonis* in several characters. The younger mesenteries are f. inst. developed as in *Actinostola*, while in *Sicyonis* the *Actinostola*-rule does not distinctly appear. Furthermore, several cycles of mesenteries have reproductive organs in *Stomphia* as well as in *Actinostola*, while in *Sicyonis* only the last cycle is fertile. The fertile mesenteries are provided with filaments in *Stomphia* and *Actinostola*, but as a rule not in *Sicyonis*. *Stomphia* agrees with *Sicyonis* in the mesenteries being more richly developed in the proximal than in the distal part, and in the double number of mesenteries of the second cycle in four (or six?) exocoels or, with another interpretation, in the rapid growth of the mesenteries of the third order in certain exocoels (compare p. 216). The mesogloea of the column is generally thinner in *Stomphia* than in both the other genera, though also in *Actinostola spetsbergensis*, especially in young specimens, the column may be rather thin. On the other hand the body-wall is sometimes thickened in *Stomphia* (compare below). A peculiarity, often displayed by the *Stomphia*-species in contracted state, is this that the central part of the pedal disc is extended tap-like. Sometimes the pedal disc of *Actinostola spetsbergensis* has the same peculiar appearance.

To the genus *Stomphia* the following species certainly belong: the type-species, *St. coccinea* (O. F. Müll.), *St. polaris* (Dan.) and *St. vinosa* (Mc. Murr.) Verr. Concerning the last species, which Mc. Murrich has described as *Paractis vinosa*, Verrill (1899 p. 295) has put forth that it is a *Stomphia*, which opinion I fully share. It is true, that Mc. Murrich does not mention more than 32 mesenteries (32 pairs compare Verrill l. c.), but the broad pedal disc indicates that in this part there have been more mesenteries, which Mc. Murrich has not observed. Verrill supposes that also *Cymbactis faeculenta* Mc. Murr. is a *Stomphia*. To judge from Mc. Murrich's description, this is certainly not the case. Mc. Murrich namely says that this species is provided with about 96 tentacles but not more than 24 pairs of mesenteries. Evidently there has been one more cycle of mesenteries developed in the distal part, — as in the Actiniaria the number of tentacles is not greater than that of the mesenteries — which Mc. Murrich has not observed. The mesenteries is therefore here probably more numerous in the distal than in the proximal part, while it is just the other way in *Stomphia*. On the other hand, it is very probable that *Cymbactis selaginella*, described by Stephenson 1918, is a *Stomphia*, though the body-wall is considerably thickened here. The whole organisation and the exterior of this species as well as Stephenson's[1] information that "a curious little imperforate mound arises from the concave centre of the basal disc" speak for this opinion. Such a "mound" is, as I have stated above, characteristic of *Stomphia*. Further the presence of "small single mesenteries" in the proximal part recalls *Stomphia*. Thus I think that *Cymbactis selaginella* is a *Stomphia*-species.

Verrill (1899 p. 217) declares that large specimens of *Stomphia carneola* = *St. churchiae* = *St.*

[1] Compare p. 211.

coccinea, have 24 pairs or more perfect and that all the perfect mesenteries are fertile. Neither Mc. Murrich (1911 p. 79) nor I myself have found this to be the case. Verrill either hinges his statement on erroneous observations, or — which is more probable — Verrill has confounded another Paractid with *Stomphia* (compare further *St. coccinea*!). For this reason I have not encluded Verrill's statement in the diagnosis.

Stomphia coccinea (O. F. Müll.) Carlgr.

Pl. 2. Figs. 1, 8.

Actinia coccinea n. sp. O. F. Müller 1776 p. 231, 1778 2. p. 30 figs. 1—3.
— — Müll. Gmelin 1788—93 p. 3133. Bruguière 1789 n. 5 Pl. 72 figs. 1, 2. Blainville 1830 p. 290, 1834 p. 324. Lamarck 1837 3. p. 540. Ørsted 1844 p. 72, 74. Johnston 1847 p. 215. Sars 1851 p. 144. Danielssen 1859 p. 45 (p. p.). Milne-Edwards 1857—60 p. 243. v. Beneden 1866 p. 189 Pl. 19 figs. 1—4.
Stomphia coccinea (O. F. Müller) Carlgren 1893 p. 138, 1902 p. 47, 1913 p. 4. Lönnberg 1898 p. 55. Mc. Murrich 1911 p. 47.
Stomphia churchiae n. sp. Gosse 1859 p. 48, 1860 p. 222 Pl. 8 fig. 5. Norman 1868 p. 440, 1869 p. 318, Schulze 1875 p. 140, Andres 1883 p. 369. Mc. Intosh 1884 p. 53. Pennington 1885 p. 173. Carlgren 1893 p. 80 Pl. 1 figs. 11, 12, Pl. 8 figs. 4—6, Pl. 9 figs. 2, 3, Pl. 10 fig. 4 textfig. 22—25. Stephenson 1918 b p. 126.
Actinia virginea sp. n. Müller 1778 Pl. 6 fig. 53.
— *carneola* sp. n. Stimpson 1852 p. 7.
Stomphia carneola (Stimps.) (p. p.) Verrill 1899 p. 206. Parker 1900 p. 753.
Actinia nitida sp. n. Dawson 1858 p. 404 figs. 3—5.
Rhodactinia davisii var. 4 Verrill 1864 p. 19, 20.
Kylindrosactis elegans sp. n. Danielssen 1890 p. 4, Pl. 2 fig. 8, Pl. 8 figs. 4, 5, Pl. 9 figs. 5—7.
Sagartia repens sp. n. Danielssen 1890 p. 45, Pl. 1 figs. 7, 8, Pl. 8 figs. 2, 3.

Diagnosis: Pedal disc very wide. Column smooth or in contracted state wrinkled. Margin rather distinct. Sphincter strong, long, reticular, sometimes with a tendency to stratification. Tentacles to about 80 in number. Actinopharynx well developed with longitudinal furrows, in number almost corresponding with those of the perfect mesenteries. Mesenteries much more numerous than tentacles. 16 to 18 pairs perfect, sometimes a few of these mesenteries consisting of a perfect and of an imperfect mesentery. Imperfect pairs in variable numbers, in larger specimens in 4 cycles, sometimes a tendency to development of a fifth cycle in some exocoels. The last cycle often represented by a single mesentery instead of a pair. Longitudinal muscles most developed in the outer part of the mesenteries. Parietobasilar muscles strong, reaching to the sphincter. No marginal stomata (always?). Typical nematocysts in the ectoderm of the tentacles $17—26 \times 1{,}5—2{,}5\ \mu$, in the actinopharynx $19—27 \times 2—2{,}5\ \mu$, spirocysts of the tentacles from $19 \times 1{,}5\ \mu$ to $60 \times 4{,}5—5\ \mu$. Besides large specific nematocysts, $34—55 \times 5—7\ \mu$ in size, in the tentacles, nematocysts with discernible basal part to the spiral thread, $22—26 \times 3{,}5—5\ \mu$ in size, in the actinopharynx.

Colour variable. Column cream-white, pale pink or flesh-coloured, irregularly marked with carmine, rose-red or scarlet, of a darker shade on the margin (sometimes the whole surface flesh-coloured or pale greenish-white, Verrill). Tentacles translucent pale pink or flesh-coloured with two circular bands of orange-red, rose-red or carmine and the tips of the same colour. Oral disc white, yellowish-white, cream-coloured, greenish-white or pale orange-red with opaque white spots at the base of the inner tentacles. Mouth surrounded by a narrow circle of rose-red, scarlet or orange-red (*coccinea*, *Churchiae*, *carneola*, Gosse, Carlgren, Verrill, Mc. Murrich).

Column milky white, strongly opalescent. Oral disc pale brownish-yellow with darker coloured, radial rows, the narrow circle of the actinostome brownish-red. Inner tentacles brownish-yellow with darker bases, outer tentacles paler with reddish tips (*Kylindrosactis* Danielssen).

Column milky white with a lustre of an exceedingly faint violet tinge. Oral disc pale buff colour. Tentacles a little darker than the disc (*Sagartia repens* Danielssen).

Dimensions. Diameter of the pedal disc unto 6,5 cm, height of the column unto 5,5 cm in preserved state.

Occurrence: Arctic coast of N. America to Cape Cod (teste Parker). Labrador (teste Packard). New Foundland Banks 45°59′ N. 51°49′ W.; 46°5′ N. 51°41′ W.; 46°6′ N. 52°3′ W. 46 fms. (Ingegerd & Gladan-Exp.). New Foundland (Verkrüzen). Jones Sound (Fram-Exp. 1900—1901).

West Greenland. Upernivik 130 fms. (Öberg 1870) (Ryder). Umanak 30—40 fms. (Torell). 70°29′ N. 55°40′ W., 70°27′ N. 55°40′ W. 50—60 fms. (Sofia-Exp. 1863). Disco bay (Rink-Exp.). Ritenbenk 15—20 fms. (Öberg 1870). Jacobshavn 35 fms. (Öberg 1870). Claushavn 40 fms. (Öberg 1870). Ikamiut (Lohmann 1905). Egedesminde 30—80 fms. (Öberg 1870) (Traustedt). Davis Strait (Holm), Nordre Strømfiord 325—330 m. Temp. at the bottom — 0,01°. Salinity 3,7° at + 3° temp. (Nordmann 1911). Holstensborg (Traustedt 1882), 20 fms. (Holm 1882). 66°45′ N. 59°30′ W. 35 fms. (Sofia-Exp. 1883). Godthaab 64°19′ N. 100—200 fms. (Ammondsen 1863). Skinderhvalen 63°3′ N. 40 fms. (Ammondsen 1863). 63°35′ N. 52°57′ W. (Ingegerd & Gladan-Exp. 1871). Bredefiord 170—180 m (Rink-Exp. 1912). Julianehaab 60°40′ N. 60 fms. (Ammondsen 1863). Pectenbanke (Traustedt 1892). Skovfiord 70—140 m (St. 156) 80—120 m (St. 152) (Rink-Exp. 1912).

Greenland without distinct locality (Traustedt 1892, Öberg and others).

Iceland. Berufiord (Torell), Dyrefiord 50 fms. (Lundbeck 1892). N. W. of Talkni 64°05′4 N. 22°55′ W. 20 fms. (Beskytteren-Exp. 1906). Öfiord (Diana-Exp. 1884)

West Spitzbergen. Bell Sound 30—40 fms. (Torell 1858). Icefiord Advent Bay 30—35 m. Bottom temp. 2—2,7° (Sw. Spitzberg-Exp. 1906 St. 73).

Green Harbour 140 m. Bottom temp. 1,1° (Michael Sars-Exp. 1901). 77°41′ N. 12°50′ E. 95 m (Olga-Exp. St. 18).

East Spitzbergen. Edge Land Devee bay 77°23′ N. 21°2′ E. 28 m (Römer & Schaudinn 1898).

Bear Island—Hope Island 75°49′ N. 24°25′ E. (Sw. Spitsberg-Exp. 1898).

Barents Sea. 74°18′ N. 31°12′ E. 269 m. Bottom temp. —0,4° (Norw. N. Atlantic-Exp. 1878 St. 275 *Sagartia repens*).

Murman coast. Eveton Eretik Isl. (Walter & Kükenthal 1889). Kola E. of Waide Guba (Sandeberg-Exp. 1877; 9—75 fms. (Alexander Kowalewsky-Exp. 22—30 fms. St. 37 1908; 23—35 fms. St. 183; 9—15 fms. St. 205; 75 fms. St. 218 1909—teste Pax). Kola peninsula (Derjugin).

Arctic coast of Siberia. 69°32′ N. 177°41′ E. (Vega-Exp. 1878). 2 miles north of the winter station of the Vega (Vega-Exp. 1879).

Behring Sea. 64°30′ N. 171°45′ W. (Vega-Exp. 1879).

Norway Finmark. Vadsø 20—40 fms. (teste Danielssen). Porsanger fiord 70°55′ N. 26°11′ E. Bottom temp. 3,5° 232 m (Norw. N. Atlant.-Exp. *Kylindrosactis*). Outer part of Kvaenang-fiord, Budder bugt and Gurbluluokta 20—50 fms (Aurivillius). Ulfsfiord 250 fms. Karlsö 30—40 fms. (Malmgren 1864). Tromsö 30—50 fms. Dons), Bjarkö 70 m (Dons). Bredvig bugt 14—20 fms. (Bjerkan)

Norway. Drontheimfiord Rödberg 25—30 fms. (Arvidsson and others), Galgeneset, Gjeiteneset 100 m (»Gunnerus«), Storfossen 200 m; N.W. of Bergen (Uddström). Bergen Hafvösund (teste Sars). Manger; Manger Vegholmen; Laurkollen 20—30 fms. (Sars). N.W. of Egersund 100 fms. (Swedish fishermens). Jäderen 100 fms. (Olsson).

Denmark. Jydske Rev 50—150 fms. (Uddström).

Skagerrak 26¼ miles N. to W. ½ W. of Hanstholm 120 m (Thor-Exp. 1907 St. 1080).

Sweden. Väderöarne *Lophohelia* reef, Gullmarfiord: S. of Löken 15 fms. (Carlgren). Smedjebrotten, Grötö; S. of Spättasbådar 20—35 m (Zool. St.). N. of Vinga light 42—16 m (Lagerberg). Varberg (Cleve).

The Sound. Ellekilde 15 fms. (Kramp). Aalsgaarde 10—15 fms. (Kramp). Hellebæk 24 fms. (Mortensen, Jungersen). S. S. W. of the light of Hallands Väderö 15 fms. (Lönnberg). Between Arild and Torekow 14 fms. (Lönnberg). Helsingborg 13—22 fms. (Gunhild-Exp.). Between Helsingborg and Landskrona (Rhamn). Landskrona (Örsted, Gunhild-Exp.). S. V. of Knäkaken 29 m (Lönnberg). N. of Hven 14 fms. (Kramp).

Great Belt. S. E. of Knuds Hoved (Mortensen).

Further distribution. The North Sea, British Islets, Shetland Isl.

Exterior aspect. The exterior of this species has been described before by various authors, wherefore further discussion of it is unnecessary. In some specimens the column is rather thick in preserved state. Concerning the pedal disc (compare p. 233).

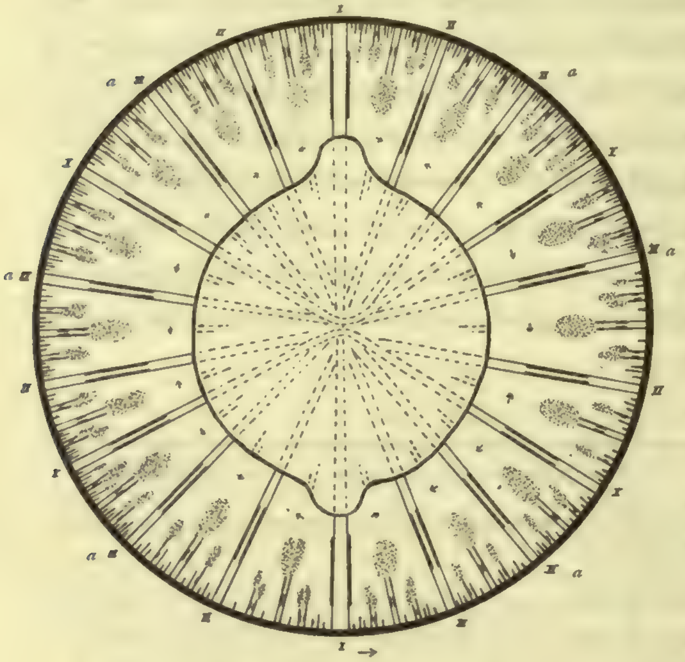
Anatomical description: The anatomy of this species has also been described by myself (1893), by Verrill (1899) and by Mc. Murrich (1911). Mc. Murrich's account of the organisation agrees with mine, except in some small details; on the other hand, Verrill's account differs from mine in some important characters, as I have mentioned above. On some points I will, however, complete my earlier observations. Concerning the stinging capsules, there are in the tentacles two kinds of nematocysts, partly typical rib-like, smaller ones (*a*), partly larger, broader in the basal end, and sometimes provided with discernible basal part to the spiral thread (*b*). In the actinopharynx we also find two kinds of nematocysts, partly typical (*a*), partly with discernible basal part to the spiral thread (*c*). In the distal part of the tentacles the largest nematocysts are found. Eight more closely examined specimens show a good agreement in the size of the stinging capsules, as shown by the following list.

Habitat	Distal part of the tentacles			Proximal part of the tentacles		Actinopharynx	
	a	*b*	*spi.*	*a*	*b*	*a*	*c*
Disco fiord	23-25 × 2 μ	48-55 × 5(6) μ	19 × 1,5—60 × 4-4,5 μ	—	—	—	24 × 3,5 μ
Skov fiord	19 × 2—26 × 2,5	41-50 × 5-7	22 × 1,5—60 × 4-4,5	19-23 × 2 μ	36-46 × 5-6 μ	23-26 × 2,5 μ	24 × 4,5-5
Egedesminde	—	—	—	17-22 × 2	34-46 × 5-6	22-25 × 2,5	24 × 5
Locality?	19-26 × 2-2,5	41-50 × 5-6	—55 × 3,5-4	—	—	19-24 × 2-2,5	24 × 5
Ikarniut	20 × 2—26 × 2,5	41-50 × 5-6	22 × 2—55 × 4,5-5	—	—	24-27? × 2,5	24-26 × 4-5
Labrador	*19 × 1,5—24 × 2	*36-53 × 5(6)	* —55 × 3,5	—	—	—	22-24 × 4,5
Dyre fiord	*19-22 × 1,5	*36-50 × 5	*22 × 1,5—50 × 4,5	—	—	22 × 2	24 × 5
Bohuslän	19-22 × 1,5-2	38-53 × 5	22 × 1,5—48 × 3,5	—	—	19-22 × 2	22-25 × 4-5

The with * designated stinging capsules also contained capsules from the proximal part. The nematocysts of the column are small, in an examined specimen their size was 14—17 × 1,5 μ.

Concerning the mesenteries, I have before (1893) put forth that the youngest mesenteries are developed according to the *Actinostola*-rule. This rule also seems to be valid as far as the older mesenteries are concerned, it is especially distinct in the first cycle of imperfect mesenteries. It is true that these latter seem to be equally developed in transverse sections, but their insertion on the pedal disc shows that both mesenteries of one and the same pair are of different size (textfigure 210). The *Actinostola*-rule is, however, not so distinct here, because the development of the mesenteries, after the appearance of the 6 first pairs of mesenteries, is not the typical one. Instead of a development of 6 pairs of mesenteries of the second order, common in the Actiniaria, 10 or 12 pairs have arisen which are all or for the greater part perfect, like the mesenteries of the first order. On textfigure 210 we see that two pairs of the second order and 3 pairs of the third order correspond to each primary exocoel. Of these latter, which form the first cycle of imperfect mesenteries, the weakest mesenteries in two adjacent pairs are facing each other — to judge from the extension of the mesenteries on the pedal disc — and stand nearest to the interjacent pairs of the second order (designated with II).

In the third pairs of the third cycle the weakest mesentery is facing the second pair of the second cycle (designated with II a, a II). The mesenteries of the third order thus seems to be developed according to the *Actinostola*-rule. Regarding the insertions of the mesenteries of the second cycle on the pedal disc, we find that also here the *Actinostola*-rule is valid. The weakest mesentery in each pair namely stands next to the mesenteries of the first order. Thus the *Actinostola*-rule appears earlier here than in the genus *Actinostola*, where it is only to be distinctly observed from the third cycle. The cause of this difference is that in *Stomphia*, provided with 18 pairs of perfect mesenteries, the number of pairs of mesenteries of the second cycle proba bly is doubled (12 instead 6), while in *Actinostola* the num ber is the typical 6. It is easy to understand that the mese nteries of the second order in a species with only six pairs of second mesenteries cannot be arranged according to the *Actino-stola*-rule. For that arrangement a reduplication of these mesenteries is first of all required.



Textfig. 210. *Stomphia coccinea.*
Diagram of the arrangement of the mesenteries. The spaced-out lines indicate the extension of the stronger mesenteries on the pedal disc. The fertile mesenteries are provided with groups of points on the inner side. The arrows in the interior of the diagram indicate the place of the weaker mesentery in the pairs of the third cycle.

The specimen of which I have above described and reproduced the arrangement of the mesenteries, was of rather considerable size (the height was about 2,5 cm and the breadth of the pedal disc 6 cm in preserved state). The number of the tentacles was 74 and the mesenteries consisting of no less than 140 paired and 72 unpaired mesenteries. Also the mesenteries of the fourth cycle and those of the following are arranged according to the *Actinostola*-rule, sometimes a mesentery of a subsequent cycle is established, before the mesentery of the preceding cycle has got its partner. As this mesentery is developed on the side away from the longitudinal muscles of the hitherto unpaired mesentery of the preceding cycles, the arrangement of the mesenteries seems apparently to be contrary to the *Actinostola*-rule. Two unpaired mesenteries of two different cycles (6 and 7) in such a case are placed beside each other. The greater part of the mesenteries are developed only in the most proximal part of the body at the limbus and mostly appear as small folds without filaments (in the textfigure these mesenteries are marked with stippled lines).

Issuing from the one directive pair (1 ⟶ fig. 210) the arrangement of the mesenteries in the more closely examined specimens was as follows. The fertile mesenteries are marked with *k*; (*k*) indicates that only the strongest mesentery of the pair is fertile; *o* signifies unpaired mesentery not having got its partner. The perfect mesenteries are designated with Roman numerals, the imperfect with common numerals.

			k		k		k		
I	6	5	4	5	3	5	4	5	6
	o			o		o			o

			(k)		k		(k)		
II	6	5	4	5	3	5	4	5	6
	o			o		o			o

			(k)		k		k		
II	6	5	4	5	3	5	4	5	6
	o			o		o			o

			k		k		(k)		
I	6	5	4	5	3	5	4	5	6
	o			o		o			o

			k
II	6	5	4
	o		

5 3 5 4 5 6 II 7 6 5 6 4 5 3 6 5 4 6 5 6 7 I 7 6 5 4 5 6 3 5 4 5 6 II 6 5 6 4 5 6 3 6 5 6 4
6 5 6 II 6 5 4 5 3 6 5 4 6 5 6 7 I 7 6 5 4 5 3 5 4 5 6 II 6 5 4 5 6 3 6 5 4 5 6 II 6 5 4 5
3 6 5 4 5 6 I 6 5 6 4 5 6 3 6 5 4 5 6 7 II 6 5 4 5 6 3 6 5 4 6 5 6 II 5 4 5 3 6 5 4 6 5 6 7
I 6 5 6 4 5 6 3 6 5 4 6 5 6 7 II 6 5 4 5 3 5 4 5 6 II 5 4 5 3 5 4 5 6.

As we see, the development of the mesenteries is a little different in the secondary compartments. In certain compartments a seventh cycle of mesenteries is present. The mesenteries of the third order and at least the strongest mesentery of the pairs of the fourth order were always fertile, the reproductive organs more rarely appear in the mesenteries of the fifth order.

When the number of perfect pairs of mesenteries exceeds 16, the exceeding mesenteries may be provided with reproductive organs. It also may happen that when certain pairs consist of a perfect and an imperfect mesentery, the former then is sterile, the latter fertile. I have never observed more than $18^1/_2$ perfect pairs of mesenteries in this species (Carlgren 1902 p. 49). Verrill's statement that 24 pairs or more sometimes are perfect, I cannot confirm (compare p. 234).

Stomphia polaris (Dan.) Carlgr.

Pl. 2. Fig. 5.

Tealiopsis polaris n. sp. Danielssen 1890 p. 45 Pl. 1 figs. 7, 8 Pl. 8 figs. 2—3.
Stomphia polaris (Dan). Carlgren 1902 p. 49.

Diagnosis: Pedal disc wide. Column and margin as in *St. coccinea*. Sphincter reticular, wide. Tentacles more than 80, unto 115. Actinopharynx with about 28 longitudinal ridges, siphonoglyphes with aboral prolongations. Mesenteries more numerous than the tentacles, 16 pairs perfect, of which 4 pairs weaker and often consisting of one perfect and one imperfect mesentery. Imperfect pairs of mesenteries in the region of the actinopharynx in 2 cycles, at the basal disc in 3. Muscles of the mesenteries about as in *St. coccinea*. Nematocysts in the ectoderm of the tentacles (19) 24—31 × 2—2,5 μ, in the actinopharynx 22—30 × 2—2,5 μ. Spirocysts of the tentacles from 19 × 1,5 μ to 53 × 3,5—4,5 μ. Large specific stinging capsules in the tentacles not present (or very seldom?).

Colour. Encrusted portion of the column whitish-gray, naked portion and also tentacles sometimes pale dirty whitish-yellow with a darker oral disc, sometimes brick-red. The red-coloured tentacles with a darker annulus in the middle, while the extremities are lighter, the whitish-yellow tentacles with a white crescent in the middle of their adoral surface (Danielssen); reddish-yellow (Rømer & Schaudinn).

Dimensions of the reproduced specimen: Heigth of the column 2 cm. Diameter of the pedal disc 2,5 cm, that of the column at the base of the tentacles 3 cm.

Occurrence: East Spitzbergen. Great Isl. 80°15′ N. 30°0′ E. 95 m (Römer & Schaudinn-Exp. St. 37).

Hinlopen Strait. 79°20′ N. 20°55′ E. 80 m (Römer & Schaudinn-Exp. St. 15).

Bismarck Strait. 78°58',5 N. 20°35' E. 35 m (Römer & Schaudinn-Exp. St. 45).
Unicorn Bay. 78°40' N. 21°31' E. 60 m (Römer & Schaudinn-Exp. St. 46).
Great fiord, Changing point. 78°15' N. 20°0' E. 105—110 m. (Römer & Schaudinn-Exp. St. 6).
W. Thymen Strait. 78°14' N. 21°45' E. 38 m (Römer & Schaudinn-Exp. St. 47).
Ryk-ys-Islets. 77°49' N. 25°12' E. 60—80 m (Römer & Schaudinn-Exp. St. 49).
West Spitzbergen. Bell Sound. 30—35 fms. (Torell).
Norway—Bear Island. 72°53' N. 21°51' E. 408 m. Bottom temp. 1,5° (Norw. N. Atlantic-Exp. St. 323).

Exterior aspect: The pedal disc is wide and irregularly folded, there are sometimes traces of radial furrows. The middle part is often, as in the anterior species, extended in a tap-like formation. The limbus is well marked. The form of the column varies with the different state of contraction and is now cylindrical, now narrower in the middle part with proximal and distal end broader (Pl. 2 fig. 5). The column is in contracted state wrinkled and the margin rather well marked. The tentacles are short, cylindrical, pointed at the apex, in contracted state irregularly wrinkled or longitudinally sulcated. The inner are considerably thicker and longer than the outer. Already in small specimens the number of tentacles exceeds the maximum of tentacles in *St. coccinea*. The number of tentacles f. inst. was 87 in a specimen, the pedal disc of which was 0,7 cm broad and the column 0,9 cm high. The number of tentacles was commonly between 95 and 115, the latter number in a specimen of which the pedal disc was 0,6 cm and the height of the column 1,4 cm. The tentacles were arranged in 5 cycles, 6 + 10 + 16 + 32 + 64, of which the last was imperfect. The oral disc is wide and provided with radial furrows, corresponding to the insertions of the mesenteries; the furrows appear most distinctly in the outer part of the disc. There are besides indistinct transversal furrows, arisen by contraction. Two distinct gonidial tubercles are present. The siphonoglyphes are broad and aborally prolongated. The actinopharynx is distinctly longitudinally sulcated, on each side of the direction plane about 14 furrows appear.

Anatomical description. The ectoderm of the column is rather high and contains few nematocysts, about 17 × 1,5 μ large. It forms a cuticle which may be incrusted with foreign bodies, probably kept together by the secretion of the mucus cells. This cuticle, which does not reach any greater thickness, however seems to be easily thrown off, as it is wanting in the specimen reproduced in the figure Pl. 1). The sphincter is reticular as in *St. coccinea*, now shorter now longer, according to the state of contraction. The distribution of the sphincter, the muscles of the tentacles, and those of the oral disc agree with those of the anterior species. The nematocysts in the apex of the tentacles are 24—31 × 2—2,5 μ in size, in the proximal part a little smaller. The spirocysts vary in size from about 19 × 1,5 μ to 53 × 3,5—4,5 μ. I have not observed any large specific nematocysts in the maceration preparations of the numerous, examined specimens. In a single, small specimen from Changing point I have, however, found such capsules in rather great numbers. Such capsules either very seldom occur, or this specimen is a hybrid *coccinea* & *polaris* with the same number of tentacles as in polaris and with large nematocysts as in *St. coccinea*. The supposition that we here have to do with a hybrid is not unlikely, as both species are very nearly related to each other. In the ectoderm of the actinopharynx I have found only typical nematocysts, 22—30 × 2—2,5 μ in size.

The arrangement of the mesenteries agrees very well with that of *St. coccinea*, I have, however, not found any more than 16 perfect pairs in the five specimens which I have examined more closely. Of these 16 pairs four are weaker than the other pairs and most frequently consist of one perfect and one imperfect mesentery, the former sterile as the other perfect mesenteries, the latter most often fertile. These weaker mesenteries were placed symmetrically on both sides of the directive plane. If we indicate the mesenteries of the first cycle with I, the stronger perfect mesenteries of the second cycle with 2 and the weaker of the same cycle with 2_1, the stronger and always perfect 2_1 mesenteries with *a*, the weaker with *b*, the arrangement of these mesenteries on both sides of the directive plane was the following $\overset{dm}{I}\ 2\ \underset{a\,b}{2_1}\ I\ 2\ \underset{a\,b}{2_1}\ I\ 2\ (I)$. In a primary dorso lateral (?) exocoel thus no 2_1-mesenteries are developed. The mesenteries besides follow the *Actinostola*-rule in their development. A specimen, the pedal disc of which was 1,8 cm broad, the height of the column 1,9 cm, and the number of tentacles 95 in the region of the actinopharynx, shows the following arrangement of the mesenteries. *o*: unpaired mesentery in this region.

$$\overset{dm}{I}\,4\,3\,4\,2\,\underset{0}{4}\,3\,4\,2_1\,3\quad I\,4\,3\,4\,2\,4\,3\,4\,2_1\,3\quad I\,4\,3\,4\,2\,4\,3\,4\quad \overset{dm}{I}\,4\,3\,4\,2\,4\,3\,4\quad I\,3\,2_1\,4\,3\,\underset{0}{4}\,2\,4\,3\,4\quad I\,\underset{0}{4}\,3\,\underset{0}{4}\,2_1\,\underset{0}{4}\,3\,\underset{0}{4}\,2\,4\,3\,4.$$

The weakest mesenteries are in the vicinity of 2_1. In the most proximal part of this specimen the number of mesenteries was 171. Thus the number of mesenteries, in comparison with that of the tentacles, is much smaller in this species than in *St. coccinea*. If we take the number of tentacles to be 1 in both species, the number of mesenteries in the named *polaris*-specimen is 1,8, in the more explicitly described specimen of *St. coccinea* 4,76. As for the rest of the organisation it agrees with that of *St. coccinea;* I have, however, sometimes found a small marginal stoma. The longitudinal muscles of the mesenteries vary in appearance, probably according to their different state of contraction, they now recall those of *St. coccinea* (Carlgren 1893), now those of *St. (Cymbactis) selaginella* (Stephenson 1918a), now they are more expanded over the whole surface of the mesenteries; the longitudinal pennons, commonly provided with higher folds than in *St. coccinea*, are however limited to the outer part of the mesenteries.

Plate I.

Plate I.

Fig. 1. *Eloactis mazelii* juv. $^2/_1$ *a*: tentacle, *b*: part of column.

— 2. *Halcampa? vegae* Carlgr. Nat. size.

— 3. *Halcampa arctica* Carlgr. not incrusted specimen from Treurenberg bay. $^2/_1$.

— 4. — — — small specimen from Besimannaja bay. $^2/_1$.

— 5. *Edwardsia* (*Edwardsioides*) *vitrea* (Dan). Proximal part of the type-specimen. $^4/_1$.

— 6. *Acthelmis intestinalis* (Fabr.) Nat. size.

— 7. — — — $^2/_1$.

— 8, 9. *Paraedwardsia sarsii* (Düb. & Kor.) = *Edwardsia carnea* of Appellöf from Herlöfiord. $^2/_1$.

— 10. *Edwardsia finmarchica* Carlgr. from Tromsø (Kier) type-specimen a little magnified.

— 11. — *vitrea* (Dan). from Wijde bay showing heteromorphosis. $^3/_1$.

— 12. — *finmarchica* Carlgr. (Goës & Malmgren leg.). $^2/_1$.

— 13, 14. *Limnactinia laevis* Carlgr. from Bohuslän. $^2/_1$.

— 15. *Paraedwardsia arenaria* Carlgr. from Skagerrak. $^3/_1$.

— 16. — — — proximal part seen from the proximal end. $^3/_1$.

— 17, 18. *Sideractis glacialis* Dan. from Sunde much magnified.

— 19. — — tentacle from the type-specimen magnified.

— 20. *Edwardsia tuberculata* Düb. & Kor. from Bergen. $^2/_1$.

— 21—27. *Peachia hastata* Gosse. Series of larvae in different developmental stages. *a*: from the oral end *b*: from the side $^6/_1$, in fig. 24 the distal end begins to get the form of an octaeder, in fig. 25 the tentacles in beginning development (compare the text).

— 28. *Peachia hastata* Gosse from Bohuslän dredged from the clay. $^3/_1$.

— 29. — — — from Bohuslän, oral disc and tentacles of the specimen reproduced in fig. 28. $^6/_1$.

— 30. *Peachia boekii* Dan. & Koren. part of the type-specimen with two tentacles, the conchula and part of the siphonoglyphe. $^3/_1$.

— 31. *Haliactis arctica* Carlgr. from Greenland. $^2/_1$.

— 32, 33. *Milne-Edwardsia loveni* Carlgr. from Väderöarne $^2/_1$, in the specimen reproduced in fig. 32 part of the cuticle removed.

— 34, 35. *Halcampoides purpurea* (Stud.) (*abyssorum* Dan.) small specimen, fig. 34 from the oral side, fig. 35 from the side. $^2/_1$.

— 36, 37. *Isoedwardsia ingolfi* Carlgr. Fig. 36 proximal end $^4/_1$, fig. 37. $^2/_1$.

Ljustr. A. B. Lagrelius & Westphal, Stockholm

Plate II.

Plate II.

Fig. 1. *Stomphia coccinea* (O. F. Müll.). Nat. size.

— 2. *Cribrina spetsbergensis* Carlgr. from Behring Sound. Nat. size.

— 3. *Actinostola spetsbergensis* Carlgr. (= *sibirica* Carlgr.). Nat. size.

— 4. — — — juv.

— 5. *Stomphia polaris* (Dan.). Nat. size.

— 6. *Anthosactis jan mayeni* Dan. from Baffin bay. Longitudinal section of the animal. Nat. size.

— 7. — — — — Mouth and actinopharynx of the type-specimen.

— 8. *Stomphia coccinea* (O. F. Müll.) pedal disc with conical off-shoot.

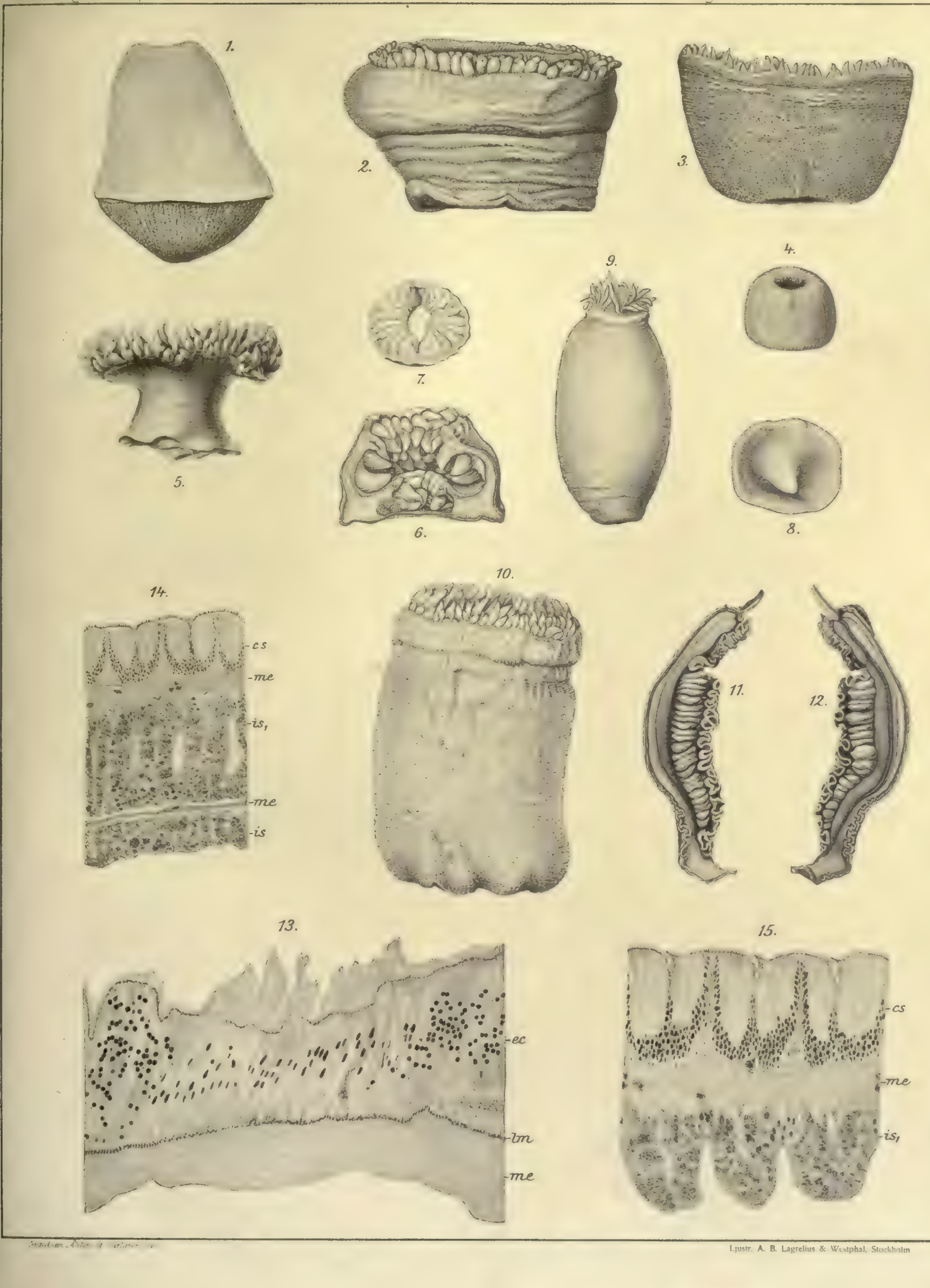
— 9. *Siphonactinopsis laevis* Carlgr. Nat. size.

— 10. *Actinostola groenlandica* Carlgr. Nat. size.

— 11, 12. *Halcampoides purpurea* Stud. (= *H. abyssorum* Dan.). Fig. 11. Mesentery seen from the side of the transverse muscles, fig. 12. Mesentery seen from the side of the longitudinal muscles.

— 13. *Peachia hastata* Gosse. Transverse section through part of the aboral prolongation of the siphonoglyphe showing the strongly ciliated boundary tract between the peculiar prolongation of the siphonoglyphe and the recurvated part (compare textfig. 132).

— 14, 15. *Halcampa arctica* Carlgr. Longitudinal section of the ciliated and of the intermediate streaks (compare the text p. 122).



Ljustr. A. B. Lagrelius & Westphal, Stockholm

Plate III.

Plate III.

Fig. 1. *Sicyonis ingolfi* Carlgr. about $^5/_8$.

— 2, 3. *Sicyonis tuberculata* Carlgr. $^5/_8$.

— 4, 5. *Pycnanthus laevis* Carlgr. $^5/_8$.

— 6. *Phychodactis patula* Appel.

— 7. *Cribrinopsis similis* Carlgr. torn-off tentacles (labelled *Zoanthus* sp. Kolafiord Derjugin).

— 8—10. *Epiactis* (*Pseudophellia*) *arctica* (Ver.). Nat. size.

— 11. *Sicyonis variabilis* Carlgr. Nat size.

— 12. *Parasicyonis sarsii* Carlgr. (from Michael Sars-Exp. 1902 St. 101). Nat. size.

— 13—15. *Actinostola spetsbergensis* Carlgr. (Nordmann St. 3b). Nat. size.

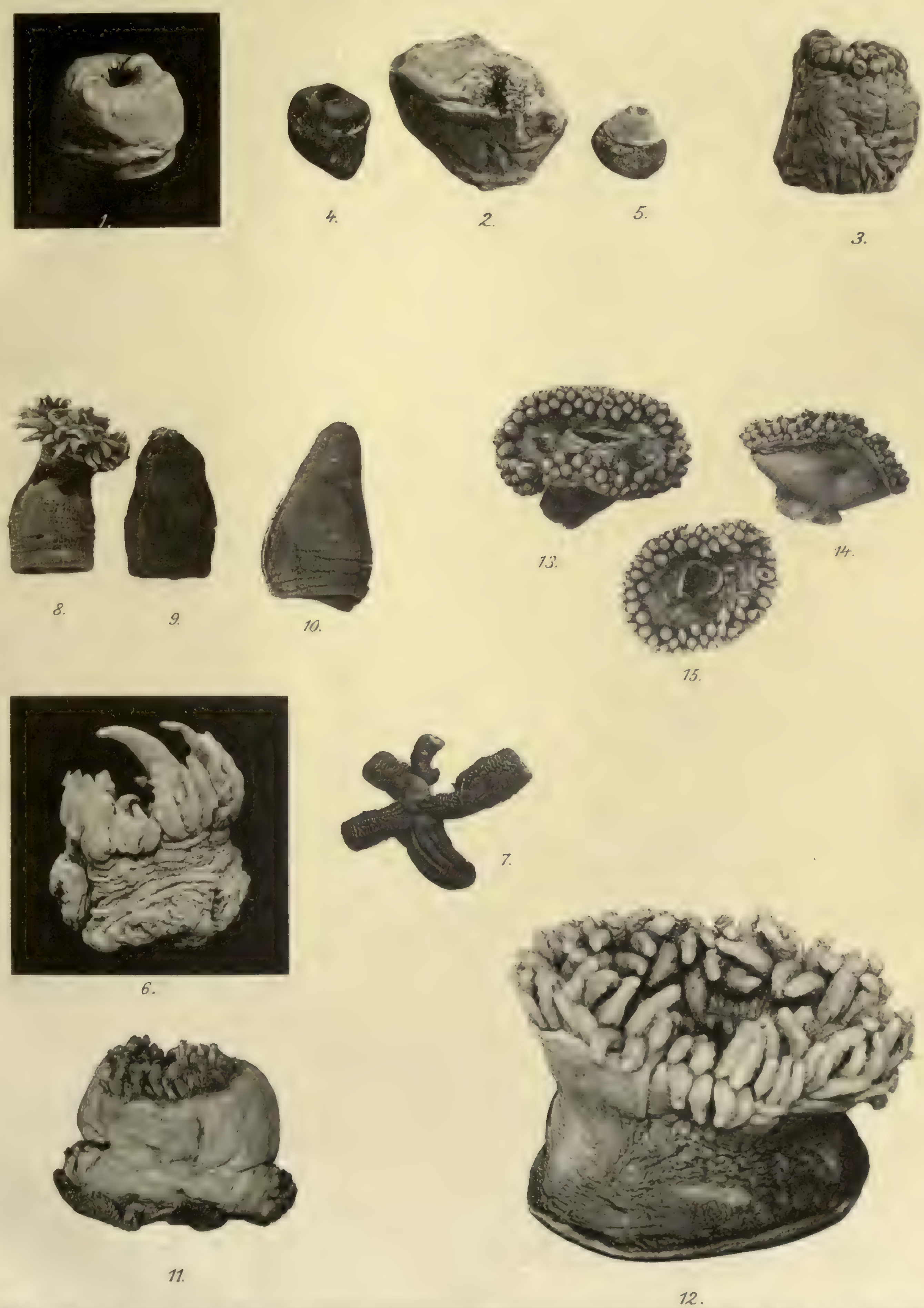

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Plate IV.

Plate IV.

ec: ectoderm, *me*: mesogloea, *c*: cuticle, *in*: incrustation.

Figs. 1—4. *Urticina felina* (L) *coriacea*.

— 1. Part of verruca, maceration preparation. Beale's carmine *s*: supporting cells, *gl.*: granulous gland cells.

— 2. *a*: supporting cells, *b*: granulous gland-cells from a verruca, maceration preparation.

— 3. Gland cells from the pedal disc, maceration preparation.

— 4. a) mucus cells, b) yellowish gland cells from the column outside the verruca.

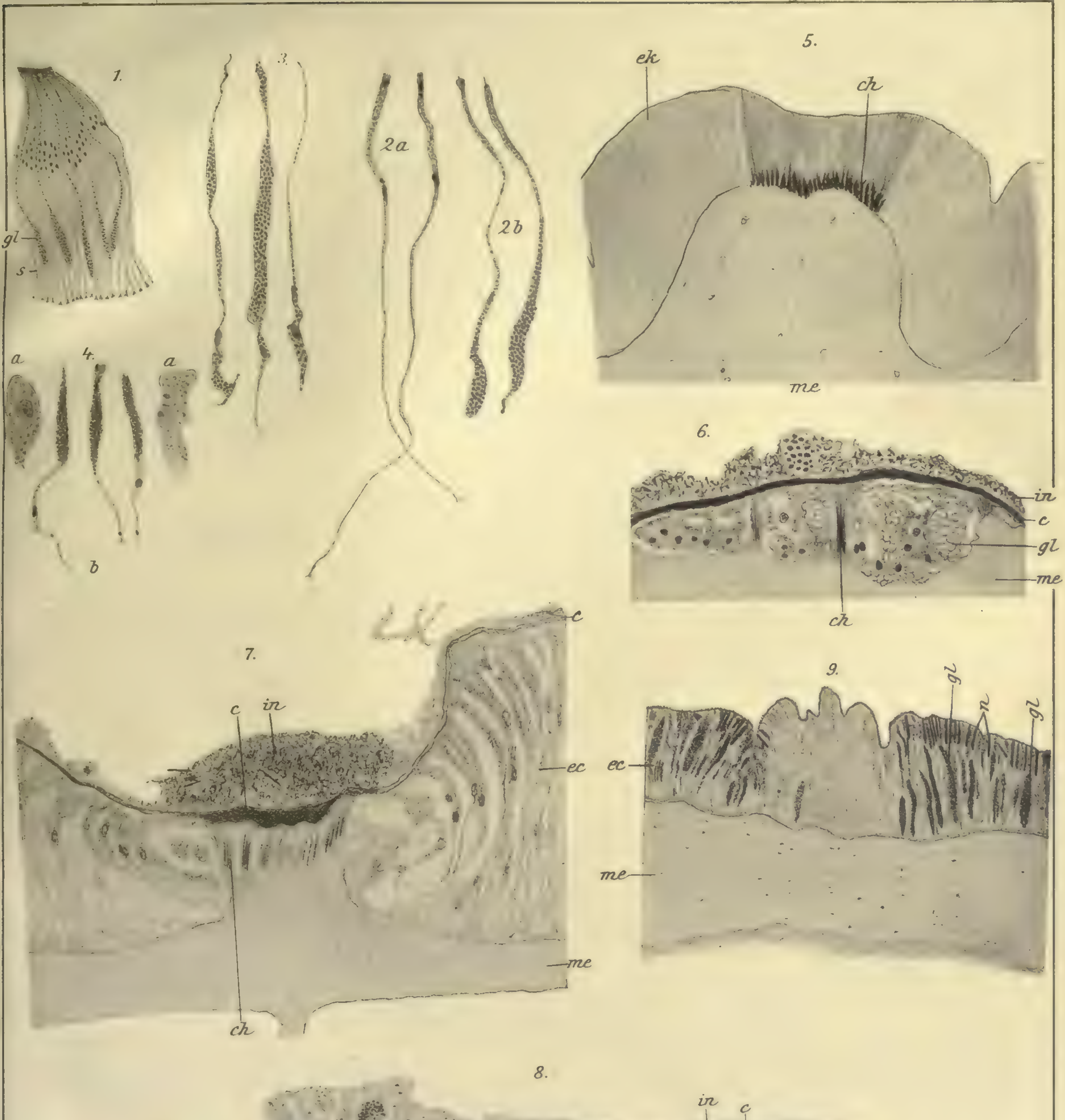
— 5. *Halcampa arctica* Carlgr. Not incrusted specimen. Transverse section through part of the scapus with a papilla. *ch*: chitinized ectoderm cells?

— 6. *Scytophorus antarcticus* (Pfeff.). Transverse section of part of the scapus. *gl*: gland cells, *ch*: chitinized ectoderm cells.

— 7. *Paraedwardsia sarsii* (Düb. & Kor.). Transverse section of part of the scapus with a papilla. *ch*: chitinized ectoderm cells.

— 8. *Halcampa duodecimcirrata* (M. Sars). Transverse section of part of the scapus with a papilla. *ch*: chitinized ectoderm cells, *gl*: gland cells.

— 9. *Epiactis arctica* (Verr.) Transverse section of part of the column with a spot. *n*: nematocysts, *gl*: gland cells.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THE INGOLF-EXPEDITION

1895—1896.

THE LOCALITIES, DEPTHS, AND BOTTOMTEMPERATURES OF THE STATIONS

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
1	62° 30′	8° 21′	132	7°2	24	63° 06′	56° 00′	1199	2°4	45	61° 32′	9° 43′	643	4°17
2	63° 04′	9° 22′	262	5°3	25	63° 30′	54° 25′	582	3°3	46	61° 32′	11° 36′	720	2°40
3	63° 35′	10° 24′	272	0°5		63° 51′	53° 03′	136		47	61° 32′	13° 40′	950	3°23
4	64° 07′	11° 12′	237	2°5	26	63° 57′	52° 41′	34	0°6	48	61° 32′	15° 11′	1150	3°17
5	64° 40′	12° 09′	155			64° 37′	54° 24′	109		49	62° 07′	15° 07′	1120	2°91
6	63° 43′	14° 34′	90	7°0	27	64° 54′	55° 10′	393	3°8	50	62° 43′	15° 07′	1020	3°13
7	63° 13′	15° 41′	600	4°5	28	65° 14′	55° 42′	420	3°5	51	64° 15′	14° 22′	68	7°32
8	63° 56′	24° 40′	136	6°0	29	65° 34′	54° 31′	68	0°2	52	63° 57′	13° 32′	420	7°87
9	64° 18′	27° 00′	295	5°8	30	66° 50′	54° 28′	22	1°05	53	63° 15′	15° 07′	795	3°08
10	64° 24′	28° 50′	788	3°5	31	66° 35′	55° 54′	88	1°6	54	63° 08′	15° 40′	691	3°9
11	64° 34′	31° 12′	1300	1°6	32	66° 35′	56° 38′	318	3°9	55	63° 33′	15° 02′	316	5°9
12	64° 38′	32° 37′	1040	0°3	33	67° 57′	55° 30′	35	0°8	56	64° 00′	15° 09′	68	7°57
13	64° 47′	34° 33′	622	3°0	34	65° 17′	54° 17′	55		57	63° 37′	13° 02′	350	3°4
14	64° 45′	35° 05′	176	4°4	35	65° 16′	55° 05′	362	3°6	58	64° 25′	12° 09′	211	0°8
15	66° 18′	25° 59′	330	—0°75	36	61° 50′	56° 21′	1435	1°5	59	65° 00′	11° 16′	310	—0°1
16	65° 43′	26° 58′	250	6°1	37	60° 17′	54° 05′	1715	1°4	60	65° 09′	12° 27′	124	0°9
17	62° 49′	26° 55′	745	3°4	38	59° 12′	51° 05′	1870	1°3	61	65° 03′	13° 06′	55	0°4
18	61° 44′	30° 29′	1135	3°0	39	62° 00′	22° 38′	865	2°9	62	63° 18′	19° 12′	72	7°92
19	60° 29′	34° 14′	1566	2°4	40	62° 00′	21° 36′	845	3°3	63	62° 40′	19° 05′	800	4°0
20	58° 20′	40° 48′	1695	1°5	41	61° 39′	17° 10′	1245	2°0	64	62° 06′	19° 00′	1041	3°1
21	58° 01′	44° 45′	1330	2°4	42	61° 41′	10° 17′	625	0°4	65	61° 33′	19° 00′	1089	3°0
22	58° 10′	48° 25′	1845	1°4	43	61° 42′	10° 11′	645	0°05	66	61° 33′	20° 43′	1128	3°3
23	60° 43′	56° 00′	Only the Plankton-Net used		44	61° 42′	9° 36′	545	4°8	67	61° 30′	22° 30′	975	3°0

Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long W.	Depth in Danish fathoms	Bottom-temp.	Station Nr.	Lat. N.	Long. W.	Depth in Danish fathoms	Bottom-temp.
68	62° 06′	22° 30′	843	3°4	92	64° 44′	32° 52′	976	1°4	118	68° 27′	8° 20′	1060	—1°0
69	62° 40′	22° 17′	589	3°9	93	64° 24′	35° 14′	767	1°46	119	67° 53′	10° 19′	1010	—1°0
70	63° 09′	22° 05′	134	7°0	94	64° 56′	36° 19′	204	4°1	120	67° 29′	11° 32′	885	—1°0
71	63° 46′	22° 03′	46			65° 31′	30° 45′	213		121	66° 59′	13° 11′	529	—0°7
72	63° 12′	23° 04′	197	6°7	95	65° 14′	30° 39′	752	2°1	122	66° 42′	14° 44′	115	1°8
73	62° 58′	23° 28′	486	5°5	96	65° 24′	29° 00′	735	1°2	123	66° 52′	15° 40′	145	2°0
74	62° 17′	24° 36′	695	4°2	97	65° 28′	27° 39′	450	5°5	124	67° 40′	15° 40′	495	—0°6
	61° 57′	25° 35′	761		98	65° 38′	26° 27′	138	5°9	125	68° 08′	16° 02′	729	—0°8
	61° 28′	25° 06′	829		99	66° 13′	25° 53′	187	6°1	126	67° 19′	15° 52′	293	—0°5
75	61° 28′	26° 25′	780	4°3	100	66° 23′	14° 02′	59	0°4	127	66° 33′	20° 05′	44	5°6
76	60° 50′	26° 50′	806	4°1	101	66° 23′	12° 05′	537	—0°7	128	66° 50′	20° 02′	194	0°6
77	60° 10′	26° 59′	951	3°6	102	66° 23′	10° 26′	750	—0°9	129	66° 35′	23° 47′	117	6°5
78	60° 37′	27° 52′	799	4°5	103	66° 23′	8° 52′	579	—0°6	130	63° 00′	20° 40′	338	6°55
79	60° 52′	28° 58′	653	4°4	104	66° 23′	7° 25′	957	—1°1	131	63° 00′	19° 09′	698	4°7
80	61° 02′	29° 32′	935	4°0	105	65° 34′	7° 31′	762	—0°8	132	63° 00′	17° 04′	747	4°6
81	61° 44′	27° 00′	485	6°1	106	65° 34′	8° 54′	447	—0°6	133	63° 14′	11° 24′	230	2°2
82	61° 55′	27° 28′	824	4°1		65° 29′	8° 40′	466		134	62° 34′	10° 26′	299	4°1
83	62° 25′	28° 30′	912	3°5	107	65° 33′	10° 28′	492	—0°3	135	62° 48′	9° 48′	270	0°4
	62° 36′	26° 01′	472		108	65° 30′	12° 00′	97	1°1	136	63° 01′	9° 11′	256	4°8
	62° 36′	25° 30′	401		109	65° 29′	13° 25′	38	1°5	137	63° 14′	8° 31′	297	—0°6
84	62° 58′	25° 24′	633	4°8	110	66° 44′	11° 33′	781	—0°8	138	63° 26′	7° 56′	471	—0°6
85	63° 21′	25° 21′	170		111	67° 14′	8° 48′	860	—0°9	139	63° 36′	7° 30′	702	—0°6
86	65° 03′6	23° 47′6	76		112	67° 57′	6° 44′	1267	—1°1	140	63° 29′	6° 57′	780	—0°9
87	65° 02′2	23° 56′2	110		113	69° 31′	7° 06′	1309	—1°0	141	63° 22′	6° 58′	679	—0°6
88	64° 58′	24° 25′	76	6°9	114	70° 36′	7° 29′	773	—1°0	142	63° 07′	7° 05′	587	—0°6
89	64° 45′	27° 20′	310	8°4	115	70° 50′	8° 29′	86	0°1	143	62° 58′	7° 09′	388	—0°4
90	64° 45′	29° 06′	568	4°4	116	70° 05′	8° 26′	371	—0°4	144	62° 49′	7° 12′	276	1°.
91	64° 44′	31° 00′	1236	3°1	117	69° 13′	8° 23′	1003	—1°0					

THE DANISH INGOLF-EXPEDITION.

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